

# **Modulation – Demodulation Software Radio**

## **How to build and setup the MDSR Software V2.6, build the LIF2012 Converter and install it into a Transceiver**

Installation procedures for FT-817, FT-857, FT-897, IC7000, IC-703 as addendum.

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### ***Another busy Year for the MDSR Team***

A lot of functionality was added last year the MDSR software. We had two releases of the software MDSR V2.5 and V2.6. Both version were extending the capabilities of the MDSR software not only by writing code, but also by integrating existing software like FL-Digi, Dream and VLAN Media player.

FL-Digi expands the capabilities of the MDR to include digital modes. FL-Digi is a extremely versatile and functional free software that is written by Dave Freese (W1HKJ) Stelios Bounanos (M0GLD) Leigh Klotz (WA5ZNU), Remí Chateauneu (F4ECW). Their website is: [www.w1hkj.com/Flidigi.html](http://www.w1hkj.com/Flidigi.html)

The Dream software has been added to extend the MDSR to provide DRM demodulation. The Dream software was developed by Menno Bakker, Julian Cable, Cesco, Stephane Fillod, Mark J. Fine, Tomi Manninen, Andrew Murphy, Gian C. Pascutto, Doyle Richard, Andrea Russo. Their website is: [www.drm.org](http://www.drm.org)

V-LAN Media Player provides the IP streaming software to stream and receive IP audio streams over the Internet. The contributors of the V-LAN software are in the 1000s and it would be too many to list them all here. Their website: [www.videolan.org](http://www.videolan.org)

Special thanks to Julian Cable for the support with the DRM presentations and Adam Farson (VA7OR) for the continued support and his test lab  
Also a big thanks to all the supporters that use and contribute to the MDSR development.

## **How to configure and use the LIF - MDSR**

### ***Introduction:***

This document brings all the resources and existing documents to the attention of the HAM operator who is interested in adding an IF sound card interface to an existing transceiver. All the documentation will be stored at the NSARC website for retrieval and easy access. All documents that are available are in PDF format.

This document also includes the instructions on how to set up the MDSR, and how to use **fldigi** in conjunction with the MDSR software. This allows the demodulation of a vast variety of digital modulation protocols.

## ***Building the LIF Kit***

The latest version of the LIF down-converter is the LIF2012. The document that describes the process is “**Digital Demodulation Project V2-42.pdf**” last updated on Sept. 24, 2012.

**Revision details:** In this update some part values were changed to provide better filtering for lower noise level. The supply voltage was changed to from 5V to 8V. Both these changes were recommended by John Sisler (KJ6ZL).

**Updating the previous kits to V2.42:** Kits that have been purchased before this revision can be updated to the latest revision. Instructions on how to perform an upgrade can be found in the “**Upgrade Instructions for LIF201x.pdf**” document.

The LIF down converter can also be used on transceivers with a 9MHz IF. The document “**Digital Demodulation Project V2-42 9MHz.pdf**” describes how the LIF has to be built to be able to handle the 9MHz IF. This document also incorporates a modified parts list.

## ***Installing a LIF port into the transceiver***

The list of transceivers that are capable of supporting the LIF – MDSR interface is growing. Lots of work has been done by the HAM community and it is documented on the MDSRadio Yahoo user group (<http://groups.yahoo.com/group/mdsradio/>). 5 radios have been modified and documented by the MDSR Team.

- **Installing a LIF port in the IC703.pdf**
- **Installing a LIF port in the IC7000.pdf**
- **Installing a LIF port the FT857 - 897.pdf**
- **Installing a LIF port in the FT817.pdf**

## ***Connecting the LIF Port to the Computer***

The 12kHz LIF output is directly connected to the “left” line input of the sound card. If there is no line input, the mic input can be used. Set the amplification setting in “Audio Settings” to -20dB to avoid overdriving the MDSR in this case.

**Note:** The line input channel can be set to the “right” input channel in the “Audio Settings” window. For LIF – RX operation, both line inputs can be connected.

## **How to install the MDSR on a Windows Computer**

### ***Introduction***

For RX the MDSR will work with almost any full duplex sound-card, but in order to meet the FCC requirement of -43dB spurious emissions for TX operation a high grade sound card is needed. The sound card that was tested and will meet the requirements is the M-Audio Audiophile M2496.

The M-Audio sound card “Properties” applet also provides level meters which are used to set up the levels for the BiLIF. The RCA input and output connectors of the card provide excellent ground and RF rejection. This audio card also provides low lag times (latency) for RX and TX.

**Note:** It is highly recommended that the M-Audio 2496 sound card be used for LIF and later BiLIF operations.

**Use the following installation program, and follow instructions.**

MDSR-Win32-SetupV2-6-Full.exe

At the end of the installation program, the Java run-time environment (JRE) has to be installed if it is not already present on the computer. The installation program automates this process. The instruction files for the MDSR-SA and the MDSR are included in the software and can be viewed by pressing the “Disk” icon on the MDSR-SA and then by selecting “Manual MDSR-J Engine” (a PDF viewer is required).

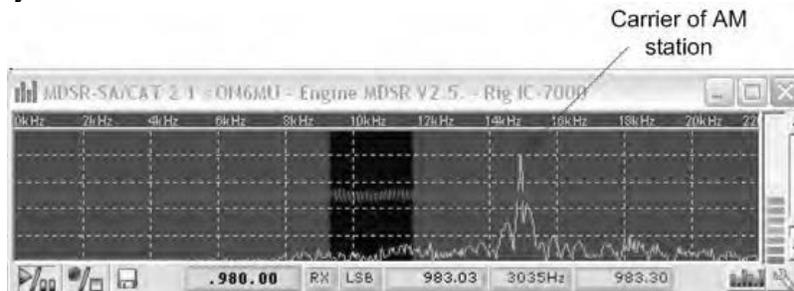
The file can also be obtained from the MDSRadio Yahoo Group in the files section.

## How to Configure the MDSR with the LIF Interface

### *Introduction*

The MDSR software has a lot of features and can be configured in many different ways. Here is an overall discussion of how RX part of the MDSR can be set up for best performance and usability.

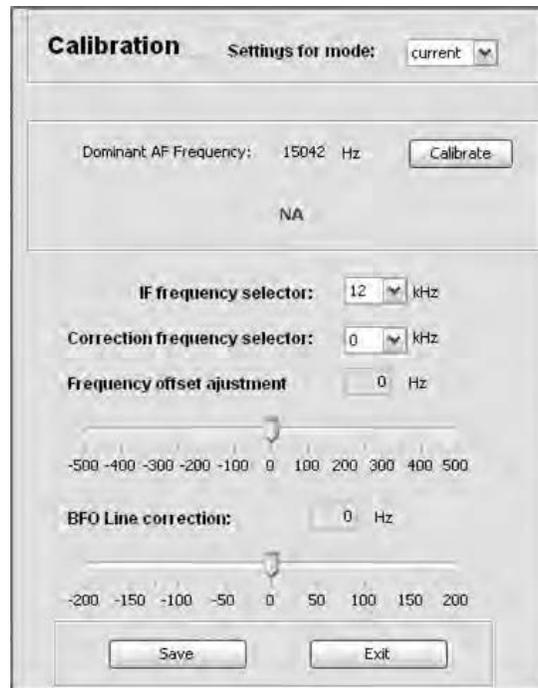
At this point the LIF kit has to be built and the LIF port is connected to the IF input of the LIF2012 kit. The 12kHz output is connected to the line input of the sound card and the MDSR software installed and running. In addition, the IF spectrum is displayed on the MDSR spectrum analyzer. The CAT interface is connected to the computer; after pressing “Start”, the frequency display matches the readout on the radio.



After tuning in a local AM station the SA (spectrum analyzer) will display the following spectrum as seen above. The audio in the speaker will be crackling or there will just be noise.

### *Calibration of the BFO*

Open the calibration window from the MDSR user interface. Go to “Setup” and then select “Calibration”. Now the following screen should be visible.



This shows that the calibration is currently set for “current” mode. This is the mode used for all operations except if the auto setup is set to “Lock to TXCR”. In this process all modes will be calibrated. It is important that the carrier frequency of the broadcast station be accurately known. The frequency display on the transceiver has to match the frequency of the broadcast signal.

- Press the “Calibrate” button. Now the dominant frequency will be detected and the BFO will be set up automatically for “current” mode.



Now the BFO line moved close to the carrier

- Fine tune the BFO line position – right on top of the carrier – with the “BFO Line Correction” slider. Press “Save” and exit the calibration window.
- In the main window press the “USB” button and the radio broadcast should be heard clearly in the computer speaker or headset. In the event that the audio is distorted and excessively loud, the input gain can be reduced in the “Audio Settings”.



To set the individual modes for “Lock to TXCR” operation, set the MDSR “Auto Setup” to “Lock to TXCR” and open the “Calibration” window again. In “Settings for Mode” select one mode at a time and repeat the previous procedure.

**Note:** As the different modes in the MDSR are selected the transceiver changes modes with the MDSR. They are locked together.

## ***Calibration of the LIF Filter Passband***

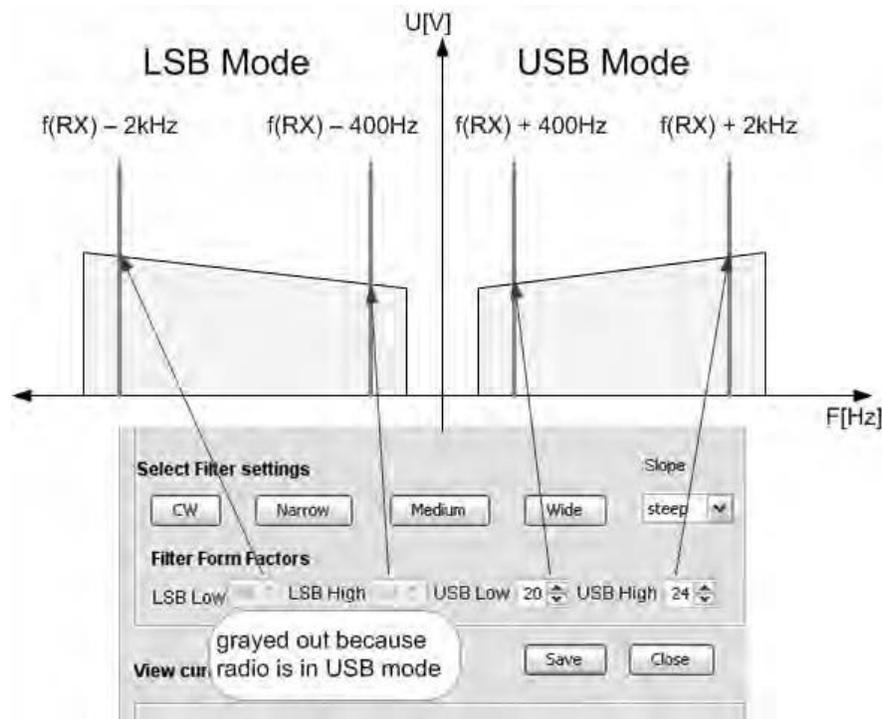
### ***Introduction***

The calibration of the LIF filter passband ensures that the USB mode and the LSB mode are exactly the same and have a flat response for most accurate reproduction of the received signal.

### **Filter Form Factors**

The Filter Form Factor adjusts the filter slope gain; this affects how the RX audio sounds. The most accurate representation of the received audio is achieved if the filter is adjusted for a flat response through the audio range 300 -2400Hz.

Each voice mode has its own selection which allows the filters to be adjusted separately, and can be tailored to the IF output of each transceiver specifically. The goal is to have USB and LSB sound exactly the same.



The filter slope settings are changed in real time on the filter, and any change will affect the audio quality of the RX audio.

### Adjustment Procedure:

A steady signal source is needed to adjust the filters. In case an RF signal generator is unavailable a local AM station carrier can also be used.

- set MDSR to LSB mode
- set the carrier at  $-2\text{kHz}$  off the BFO line into the left side of the filter box
- adjust the radio gain until it reads S9 on the meter
- adjust the “LSB Low” level up or down until the MDSR S meter also indicates S9
- set the carrier at  $-400\text{Hz}$  off the BFO line to the right side of the filter box
- adjust the “LSB High” level up or down until the MDSR S meter also indicates S9
  
- set MDSR to USB mode
- set the carrier at  $+2\text{kHz}$  off the BFO line into the left side of the filter box
- adjust the radio gain until it reads S9 on the meter
- adjust the “LSB Low” level up or down until the MDSR S meter also indicates S9
- set the carrier at  $+400\text{Hz}$  off the BFO line to the right side of the filter box
- adjust the “LSB High” level up or down until the MDSR S meter also indicates S9
- click on the “Disk” Icon of the SA, go to the “Profile Manager” and create a backup of all the settings

If the filter settings are done correctly, the USB and LSB modes will sound exactly the same when receiving an AM station.

**Caution:** The filter values have to be around 20 and should not go below 10. Settings above 50 will have a negative impact on the filter selectivity. Values below 0 will crash the audio engine, in which case the MDSR has to be reset.

## Calibration of the LIF Filter Passband for AM

### Introduction

The AM demodulator used in the MDSR is a synchronous AM detector. Instead of using the BFO to demodulate the IF the incoming IF is amplified and then limited to create a synchronous carrier that feeds the mixer input. In case the signal is too weak and a synchronous carrier cannot be generated the modulator switches on the BFO for DSB reception.

The MDSR has a separate filter setting for the AM reception and the sync. threshold has to be calibrated.



#### Calibration Procedure:

- set the MDSR to AM and tune in a non fading AM station (peak at center)
- lower the incoming signal to reduce signal strength to S2 level
- press F2 (Setup – RX parameters)
- move the carrier off by -4kHz and then adjust AM Low up or down until the AM Sync indicator flashes (if the setting is too high it will go off and if it is too low it will stay on)
- move the carrier off by +4kHz and then adjust AM High up or down until the AM Sync indicator flashes (if the setting is too high it will go off and if it is too low it will stay on)
- click on the “Disk” Icon of the SA, go to the “Profile Manager” and create a backup of all the settings

## Using Dream to demodulate DRM mode

### Introduction

The Dream V1.5 DRM demodulator is included with the [MDSR-Win32-SetupV2-51.exe](#) and in the [MDSR-Win32-SetupV2.6-Full.exe](#) setup file. Clicking on the DRM button will launch the Dream application and if there is a DRM signal available it will decode it and broadcast through the soundcard speakers.

#### Setup:

The soundcard input and output for the Dream software should be all default settings.

#### Evaluation Dialog:

In the evaluation dialog the connection quality and the status of the decoding process can be observed.

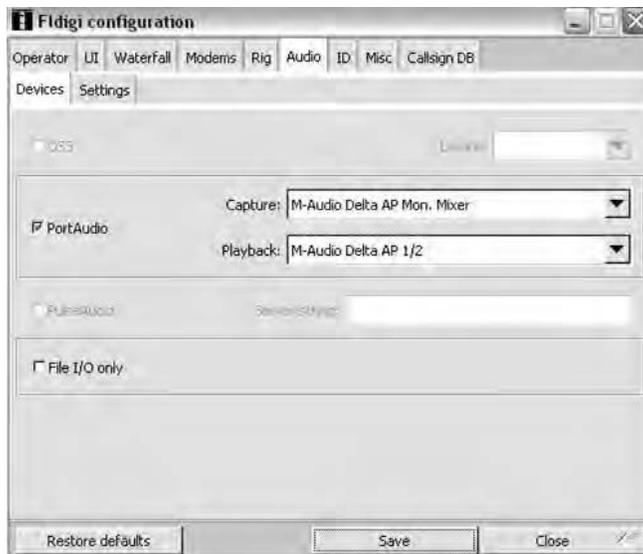
**Note:** to decode a DRM signal, the signal strength needs to be high and the S/N ratio has to be at least above 12dB

## Using fldigi to demodulate digital modes

### Introduction

**Fldigi** is probably one of the most versatile shareware programs for the demodulation and modulation of all types of digital transmissions, including the decoding of CW. Depending on the sound-card that is used, the setup of **fldigi** is simple.

Once it is installed, click on “Configure”, select “Sound Card” and then select the “Audio” tab. Under devices check “Audio Port”. In the Capture field select the output of the sound card you are using. If you use a M-Audio 2496 the configuration window will look like the one below.



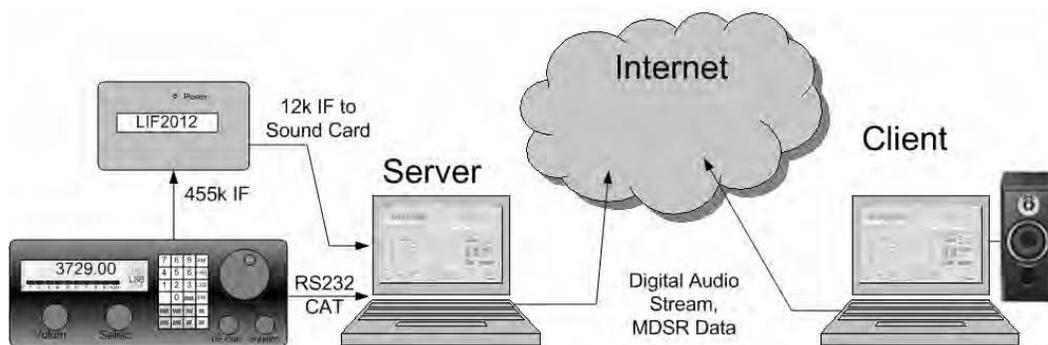
Once the right audio channel has been selected the waterfall display will change color, indicating the presence of a signal. Further adjustments to best suit your setup will have to be made in **fldigi**.

**Note:** Some audio cards will require a jumper cable from the audio output to a second sound card’s line input.

## Setting up MDSR Remote Server and Client

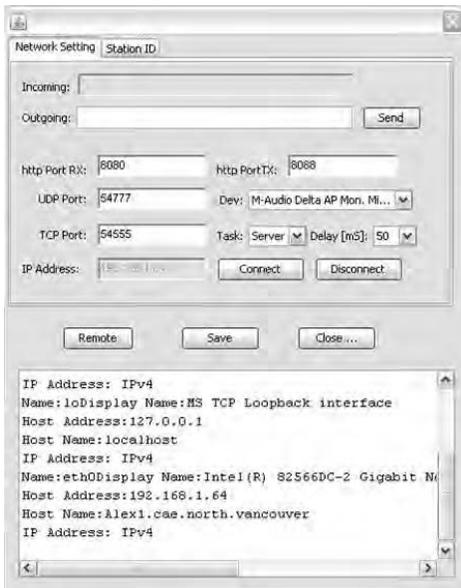
### Introduction

The MDSR remote server/client allows two computers that run MDSR to be connected together via an Internet connection. The MDSR Server is connected to the transceiver and redirects all the settings from the client, which then updates the radio via CAT control.



### **Server setup:**

The MDSR setup that directly connects to the transceiver has to be set up as “Server”. Once the server is set up and started it will send a digital audio stream and it also will listen to the TCP port for a handshake signal. (Note: the handshake is very specific; there is no concern to get viruses via the MDSR network port). After the server is configured and the “Station ID” tab has been filled in press “Save” to permanently store the information on the hard-drive.



The image below shows the server setup of the MDSR test platform, right after the “Remote” set-up window is opened. All the port settings are default and do not need to be changed, unless there is a device conflict. The displayed IP address is the server’s own address and has to be replicated on the client. (Note: the IP address shown is a private IP which is only visible on the local network – if this device needs to be accessed outside of the local network “Port Forwarding” has to be enabled on the router).

The delay time can be selected to provide the most stable connection between server and client.

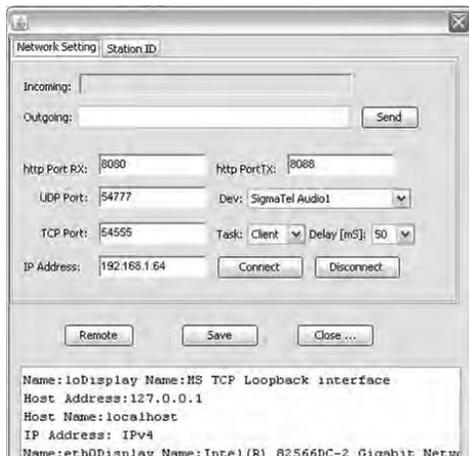
The text area at the bottom shows the network adaptors that are present on this computer and identifies the local host address as 192.168.1.64.

### **Setup of the VLC audio stream:**

The VLC streamer is setup and starts automatically once the “Connect” button has been pressed. In order for the correct audio channel to be streamed to the “Client”, the “Dev” selector box has to show the audio device that outputs the demodulated audio (on the MDSR test platform, this is: M-Audio Delta Mon, Mixer). Select the correct device from the list by clicking on the down arrow left of the field.

### **Setup of the MDSR “Client”:**

The image on the left shows the “Client” set-up that connects to the above configured “Server”. Except for two fields the setup is identical. The “Dev” setting is different because it uses different hardware and the “Task” is now set to “Client”.



### **Connection Procedure (Server Side):**

Press the “Connect” button on the “Server”. The “Incoming Message” states “Waiting for Connection...” and the VLC Streamer starts. If it works correctly the timer on the left side will increase as time proceeds. If the VLC player displays an error select a different audio device.

### **Connection Procedure (Client Side):**

Press the “Connect” button on the “Client”. Now the message changes on the “Server” to “You are connected to the MDSR Client”. The “Client” incoming message changes to “You are connected to the MDSR Server”.

### **Using Text messaging between “Client” and “Server”:**

At this stage it is possible to communicate via text-messaging to the other computer. Type a message into the outgoing text field and press the send button. The message disappears and is sent to the other computer’s “Incoming” field.

### **Taking control of the “Server” MDSR with the “Client MDSR:**

By pressing the remote button on the “Client” the data exchange between the “Server” and “Client” starts. This can be seen in the “Incoming” and “Outgoing” fields as well as in the big text field on the bottom. At the same time the VLC listener will start and connect to the streamer on the server. It will take about 5 to 10s for the audio to be heard over the speaker. If VLC displays a timeout message the audio streamer on the server has a problem or did not start.

Once the remote connection has been initialized the “Station ID” area is updated and shows the callsign and the location of the connected station. The “Data” indicator will flash indicating active data exchange between “Server” and “Client”.

Depending on the quality of the network connection there is some lag of the audio coming out of the client. The audio quality is comparable to MP3s streaming mono at 64kB/s.

**Note:** Once the remote process has commenced, the “Remote” window can be closed without disconnecting the data connection.

### **Disconnecting the “Client” from the “Server”:**

There are multiples ways the connection between the “Server” and the “Client” can be broken.

- Disconnect the “Client” from the “Server” location.
  - Press the “Disconnect” button on the main screen
  - Press the “Disconnect “ button on the remote screen

**Note:** In both instances a message is sent to the “Client” and the MDSR on the client will be returned back to the standalone mode. To turn off the “Server” press “Disconnect” again. In order for the “Client” to connect again, the “Server” has to be restarted manually by pressing “Connect”.
- Disconnect the “Client” from the “Client” location.
  - Press the “Disconnect” button on the main screen
  - Press the “Disconnect “ button on the remote screen

**Note:** In both instances a message is sent to the “Server” and the MDSR on the client will be restored to the standalone mode. After 10 sec. the “Server” will reset and another “Client” can connect to it.

**Attention:** Never shut down the “Client” or the “Server” without severing the network connection first. If the network is terminated dirty, the MDSR “Client” is not restored to the stand-alone mode and it will retain the settings of the “Server”.

If this happens restart the “Client” again, wait for a few seconds, and shut down the “Client” again. Now the “Client” will start up with the local stand-alone settings. If the settings have not been restored by this point, open the “Profile Manager” and restore the last good profile.

## ***Conclusion***

This completes the overview and setup instruction document. We hope you were able to set up the MDSR software and can now enjoy the best RX audio ever received by your transceiver. Tell your friends about MDSR and how it improved your RX audio quality.

### **73. The MDSR development team**

To order the PCB kit including all parts or for more information please go to;

**<http://users.skynet.be/myspace/mdsr>**

# Installing a LIF port into the IC-703 transceiver

## *Intro*

This document describes the procedures for installing a LIF (Low Intermediate Frequency [10 – 17kHz]) port into the ICOM-703 transceiver. This procedure requires a high level of expertise to dismantle the transceiver, to solder and to drill a hole. With this in mind, the installation is straight forward and should not cause any difficulties for the experienced HAM operator.

It is important to unplug all connectors and power before working on any transceiver. It is also important to be grounded to avoid static discharges.

Please note: no responsibility or liability will be taken by the author of this document.

## ***LIF port installation***

### **Dismantling the Transceiver**

The top cover of the radio must be removed. There are 8 screws that need to be removed and then the lid will come loose. Remove the lid carefully because the speaker cable will still be connected to the circuit board. Unplug the speaker. Now remove all the screws that hold down the PCB (9 in total). The three white ribbon cables have to be unplugged by slightly pulling on them. The two coaxial cables in back have to be gently unplugged. Now the board can be twisted out, starting at the front.

### **Drilling the Hole**

A SMA connector is the preferred connector because of its small size. A BNC or a RCA connector will also work in the case that a SMA connector is not available. A hole will need to be drilled next to the phone plug for the Morse key. Make sure the hole clears the screw stud and is high enough to allow space for the coaxial cables.

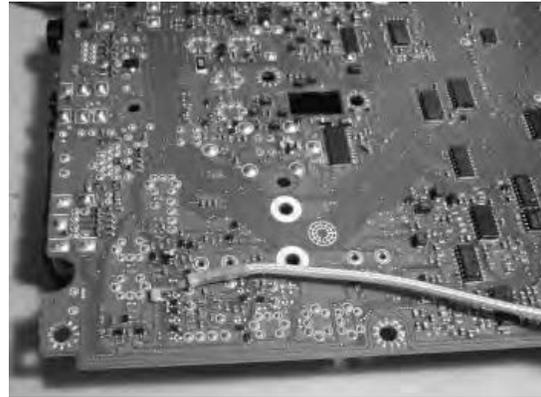
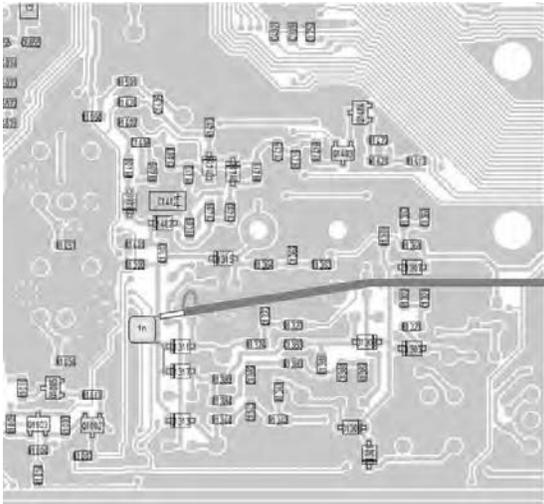
Before drilling the hole, cover all the cutouts to the lower PCB with masking tape to prevent metal shavings from falling into the lower part of the transceiver. Blow out the metal dust and clean the surfaces of all dust before reassembling.



### **Connecting the RG174 cable to the PCB**

The 455kHz bidirectional port of the IC-703 is on the bottom side of the top circuit board. The RG174 cable center is soldered onto a 1nF ceramic decoupling capacitor.

The Layout design drawing (below left) and the picture of the actual PCB (below right).



The other lead of the capacitor is bent by 90 degrees and soldered onto the cathode side of D311 and D317. For mechanical stability, it is advisable to solder to both diodes. During this process, care has to be taken to not overheat the SMD components. The shield of the coaxial cable is soldered to the ground pin on the PCB. Cover the exposed shield with heat shrink as shown in the picture above.

### **Routing the cable and reassembling of the transceiver**

There is enough clearance to route the cable underneath the PCB. Because there is not enough space to bring the cable up on the sides, it has to be routed through the front and then all the way back again to the rear wall where the hole was drilled.



When placing the PCB into the enclosure, the rear has to line up first and then, with a twisting motion, the rear connectors will move into the proper holes. While doing this, hold the ribbon cables so that they do not get stuck under the board. Now replace all the screws and the metal clip holding down the PLL shield. Plug in the red and green coaxial cables and the three white ribbon cables (do not twist them; align them properly before pushing them gently into place).

Recheck all the connections and the placement of all the screws. Now place the lid onto the transceiver, plug in the speaker cable and push the lid into place. Replace all the screws into the lid.

That completes the installation of the LIF port of the IC-703. The MDSR team wishes you all the best and if you like the performance of the MDSR software please tell all your friends about it.

73, The MDSR development team

# Installing a LIF port into the IC-7000 transceiver

## *Intro*

This document describes the procedure for installing an LIF (Low Intermediate Frequency [9 – 18kHz]) port into the IC-7000 transceiver. This transceiver has a high level of integration and already offers IF-DSP technology. Nevertheless, connecting it to the MDSR has the advantages of improving audio clarity and the reduction of hiss on low level signals. The noise reduction system of the IC-7000 is effective, but also makes the RX audio “boomy”. The MDSR has a real-time spectrum analyzer, which does not affect the audio quality. The demodulation system of the IC-7000 works very similarly to the MDSR. But the MDSR has the advantage that it utilizes the PC, which has a much more powerful processor.

This procedure requires a level of expertise to dismantle the transceiver and to solder. Nonetheless, the installation is straightforward and should not cause any difficulties for the experienced HAM operator.

It is important to unplug all connectors and power before working on any transceiver. It is also important to be grounded to avoid static discharges.

**Please note:** no responsibility or liability will be taken by the author of this document.

## ***LIF port installation***

### **Dismantling the Transceiver**

The top cover of the radio must be removed. There are 8 screws that need to be removed and then the lid will become loose; there are 4 screws on the top cover and 2 on each side. Remove the lid carefully; the speaker cable will still be connected to the circuit board. Unplug the speaker. In order to extract the DSP assembly, two screws must be removed. When taking the DSP assembly out, make sure that the gray audio cable does not get pulled with the assembly.

An easy way to route the shielded RG-174 cable outside is to remove the automatic antenna tuner plug. If this plug is required, an SMA connector can be mounted on the left corner just above the ground screw. This requires drilling a hole. To do this safely, all the PCBs on the top must be removed, and all the holes that connect to the lower PCB must be covered with masking tape to prevent metal shavings from falling onto the PCBs. After drilling, all the metal shavings have to be wiped up with a slightly wet cloth. Reassembling the unit can be difficult, especially the refitting of the ribbon cables.

### **Connecting the RG174 cable to the PCB**



The connection point is the 455kHz FL901 filter. This provides bidirectional (RX and TX) connectivity of the IF. If the transceiver is in RX mode the 455kHz IF can be extracted from this port and if it is in TX mode and a 455kHz signal is inserted, the radio will up-convert it and send it to the TX PA.

A 10n ceramic capacitor is connected to the left top pin of the FL901 filter. This capacitor is connected to the center conductor of the RG174 coaxial cable. The ground for the shield is connected to the lower (in center) ground connection of the filter. When the DSP is placed back on the PCB, this capacitor has to clear the rim of the DSP shield. Replace the two screws that hold the DSP assembly and tighten them.

**Routing the cable and reassembling of the transceiver**

The RG174 routes on the left side underneath the DSP assembly. If the coaxial cable is routed outside where the antenna tuner plug used to be, a tie wrap is needed to secure the cable to prevent pulling.

If the SMA connector is mounted on the enclosure, the cable shield has to be soldered to the shield for the RG45 (rear mic.) connector.

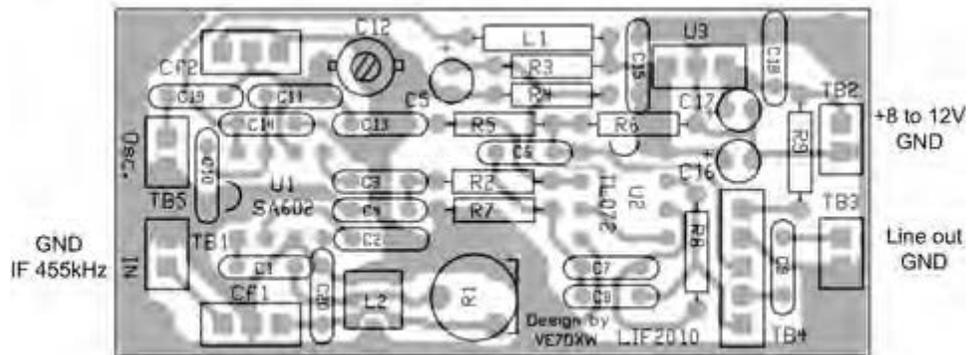
Before the lid is placed back, the speaker needs to be plugged in.

**Connection of the LIF converter**

This transceiver does not provide option filter slots. All the filtering is done in DSP. The LIF port does not have to be enabled; it is active all the time.

**Note:** The transmit audio is still filtered with the DSP filter inside the IC-7000. If the MDSR is properly configured, the standard microphone can be used to transmit, while the RX is processed through the computer.

For more details see the MDSR help menu.



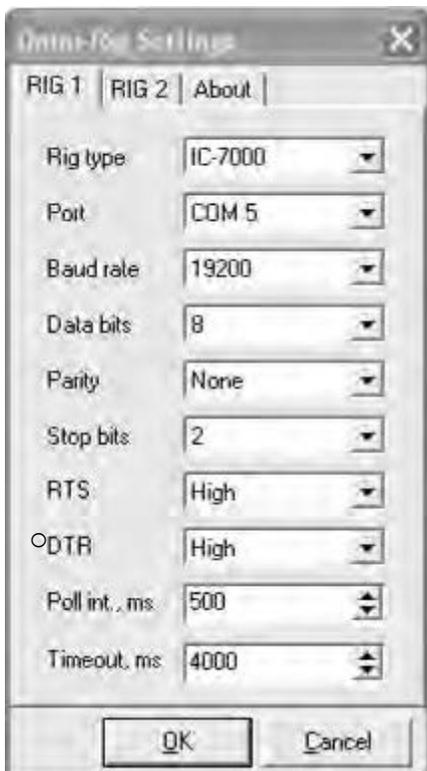
LIF2011.ASM 01/14/11

**Setup of the CAT interface**

The MDSR software controls the transceiver via the CAT port. The connector cable CI-V is the Icom version of the interface cable that plugs into the back of the radio and the RS-232 port of the computer. There are also virtual RS-232 cables available that connect via the USB bus to the computer.

### OmniRig Setup for the IC-7000 series transceivers

To enter setup menu in MDSR-SA, select the tool icon at the bottom right and select “OmniRig Configuration & Status”, select the key icon “Configure OmniRig”. Only configure RIG 1.



- Select the transceiver to be controlled from the drop down menu.
- Select the port of the computer. If the Com port is not known, go to the “Device Manager” and select the ports icon. The port number should be listed there.
- The Baud Rate has to match the setting in the Transceiver. The default setting for the IC-7000 is “auto”. The highest rate is 19200.
- All the other settings should be as displayed here.

This completes the installation of the LIF port of the IC-7000. The MDSR team wishes you all the best and if you like the performance of the MDSR software please tell all your friends about it. Distribute this document freely or post it on your website.

### **73, The MDSR development team**

To order the PCB kit or for more information please go to;

<http://users.skynet.be/myspace/mdsr>

# Installing a LIF port into the FT-857/897 transceiver

## *Intro*

This document describes the procedure for installing a LIF (Low Intermediate Frequency [9 – 18kHz]) port into the FT-857 or FT-897 transceiver. These transceivers look quite different on the outside but share the same set of PCBs. This procedure requires a level of expertise to dismantle the transceiver and to solder. Nonetheless, the installation is straight forward and should not cause any difficulties for the experienced HAM operator.

It is important to unplug all connectors and power before working on any transceiver. It is also important to be grounded to avoid static discharges.

**Please note:** no responsibility or liability will be taken by the author of this document.

## ***LIF port installation***

### **Dismantling the Transceiver**

The top cover of the radio must be removed. There are 7 screws that need to be removed and then the lid will become loose; there are 3 screws on the top cover and 2 on each side. Remove the lid carefully; the speaker cable will still be connected to the circuit board. Unplug the speaker.

### **Connecting the RG174 cable to the PCB**



Solder the ground shield of the RG174 to the first 3 pins of J23. This will also make the option filter 1 selectable in the radio's menu. Pin 4 is the RF and it needs to be connected to the center of the RG174 coaxial cable and to the input of the 455kHz filter. The center pin of the filter is connected to pin 2 of J24 and the output is connected to pin 3. The filter is secured on the PCB with double sticky tape. The filter will keep the AGC function working. The audio of the radio has to be turned off. Pin 1 of J24 stays empty.

### **Routing the cable and reassembling of the transceiver**

The best routing of the RG174 is shown below for the FT-857. The coaxial cable is secured with a tie-wrap to the power cable. The LIF PCB has to be mounted outside of the transceiver.



The best routing of the RG174 is shown below for the FT-897. The LIF PCB can be mounted inside the transceiver. The PCB has to be made slightly smaller to fit into the gap, as shown, with sand paper. Power is provided through the regulator IC on the upper PCB. Use the +12V side of the regulator IC. The LIF PCB has its own regulator.

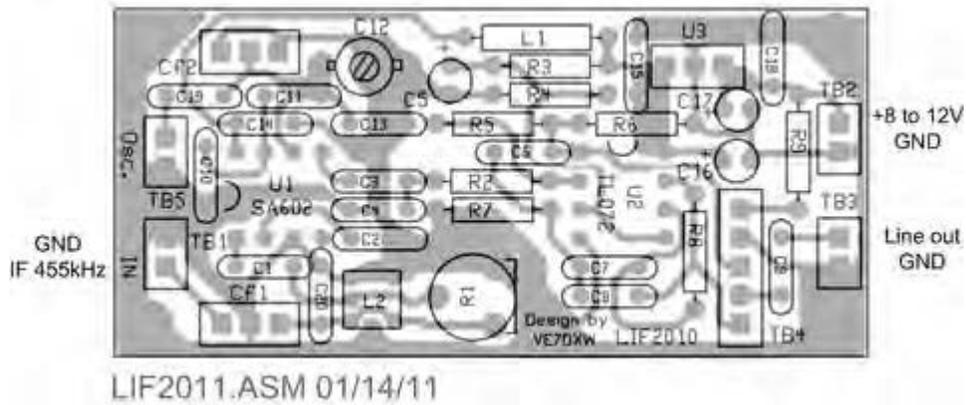


### ***Connection of the LIF converter***

The LIF output of the transceiver connects to the IN port of the LIF assembly and the audio Line out connects to the sound card. To route the RF into the LIF converter the option filter 1 has to be selected in the filter menu.

**Note:** The transmit audio is still filtered with the existing filter inside the FT-857/897. If the MDSR is properly configured the standard microphone can be used to transmit, while the RX is processed through the computer.

For more details see the MDSR help menu.

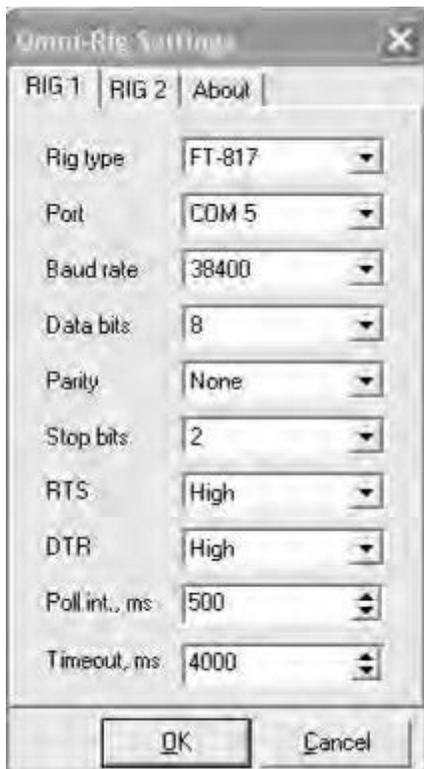


## Setup of the CAT interface

The MDSR software controls the transceiver via the CAT port. The connector cable CT-62 is the Vertex Standard version of the interface cable that plugs into the back of the radio and the RS-232 port of the computer. There are also virtual RS-232 cables available that connect via the USB bus to the computer.

### OmniRig Setup for the FT-8x7 series transceivers

To enter setup menu in MDSR-SA select the tool icon at the bottom right and select “OmniRig Configuration & Status”, select the key icon “Configure OmniRig”. Only configure RIG 1.



- Select the transceiver to be controlled from the drop down menu.
- Select the port of the computer. If the Com port is not known go to the “Device Manager” and select the ports icon. The port number should be listed there.
- The Baud Rate has to match the setting in the Transceiver. The default setting for the FT-857 is 4800. It can be changed to a higher performance if needed (see transceiver manual).
- All the other settings should be as displayed here.

That completes the installation of the LIF port of the FT-857/897. The MDSR team wishes you all the best and if you like the performance of the MDSR software please tell all your friends about it.

### 73, The MDSR development team

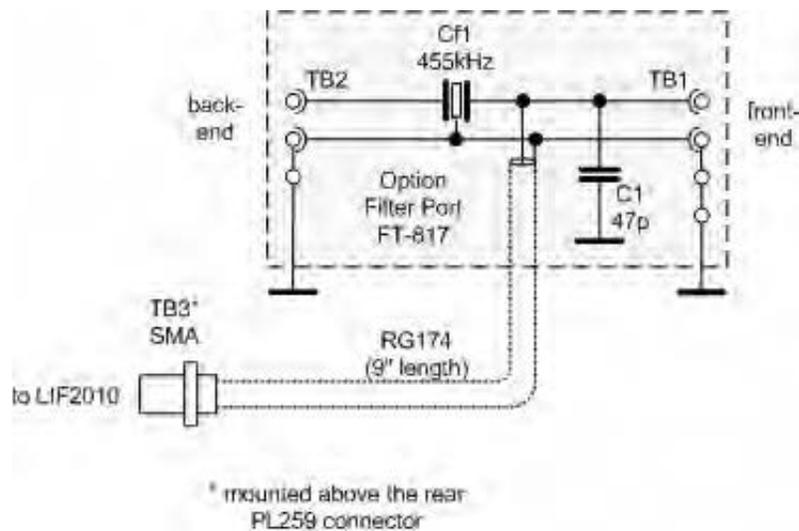
To order the PCB kit or for more information please go to <http://users.skynet.be/myspace/mdsr>

### Option filter port extended to the rear of the radio (FT-817)



A small circuit board serves as a platform to solder the 0.075" spacing strip connector as well as a 470pF capacitor.

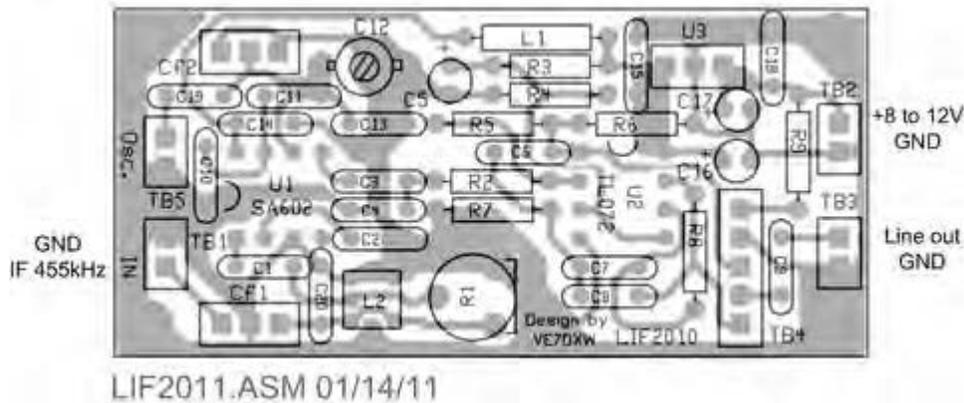
A small rubber cube glued on top of the PCB insulates and secures the assembly when the lid is closed. The shielded cable is RG174 and the connector on the rear wall of the radio is a SMA male, chosen for its small size. This mod does not impact the portability of the unit nor does it affect performance in any way. From here, it connects to the bidirectional input of the Bi-LIF converter.



### **Connection of the LIF converter**

The LIF output of the transceiver connects to the IN port of the LIF assembly and the audio Line out connects to the sound card. To route the RF into the LIF converter the option filter has to be selected for SSB in the filter menu #38.

**Note:** The FT-817 has only one internal filter for TX and RX. In this configuration the radio can not be used to transmit through the internal microphone.

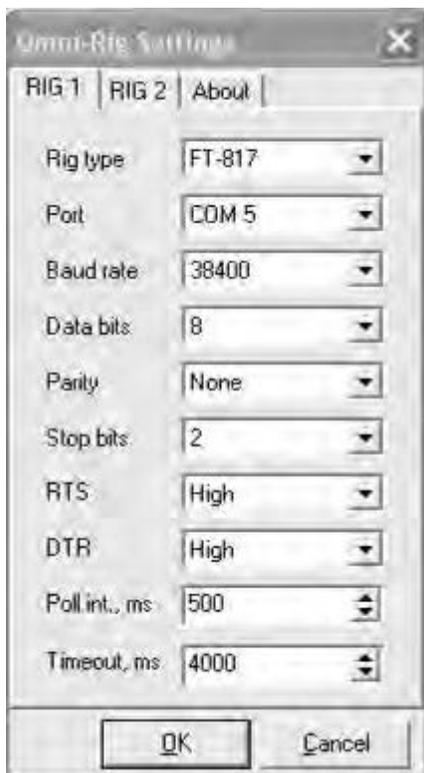


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- The Baud Rate has to match the setting in the Transceiver. The default setting for the FT-857 is 4800. It can be changed to a higher performance if needed (see transceiver manual).
- All the other settings should be as displayed here.

That completes the installation of the LIF port of the FT-817. The MDSR team wishes you all the best and if you like the performance of the MDSR software please tell all your friends about it.

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## KENWOOD TS-2000 12 kHz IF Output

The KENWOOD TS-2000 transceiver has a final intermediate frequency of 12 kHz. This frequency is suitable for a number of external applications, such as Digital Signal Processing (DSP) and an external DRM demodulator. Both digital signal processing and demodulation of DRM signals can be done with a PC with soundcard and suitable software. Unfortunately KENWOOD haven't made a 12 kHz IF Output. However, if you are comfortable working with surface mounted components and delicate electronics; you can make your own 12 kHz IF Output on your TS-2000. This modification is based on a description I received from LA6XJ Kjell Holen, and slightly modified by my self LA8OKA Martin Storli. My modifications are the use of the ACC2 Connector as a mean of permanent output, and the use of a 1 $\mu$ F Capacitor. (Kjell Holen used a 22 nF Capacitor.)

*Before you do this, please make sure you understand the consequences this modification or failure of this modification can lead to:*

- *The warranty of your TS-2000 will be void!*
- *You may damage your TS-2000 beyond repair!*
- *I will not accept any responsibilities or liabilities of what you or any other persons choose to do with your or anyone else's TS-2000 transceivers.*
- *If you have never done anything similar to this before: **FORGET ABOUT IT!***
- *Working with electronics without paying close attention to safety may kill or seriously harm you or someone else!*
- ***Make sure you know what you are doing!***

### Work description:

- Disconnect the power supply, all the antenna cables, the ground wire and any other cables and wires connected to the TS-2000 transceiver.
- Turn the TS-2000 transceiver upside down, with the front facing towards you.
- Remove the bottom cover.
- Take a close examination of the Block Diagram in Fig. 1 and the Schematics Diagram in Fig. 2. Note that a new 1 $\mu$ F Capacitor will be connected to the emitter of the Q42 Transistor. This is the new 12 kHz IF Output.

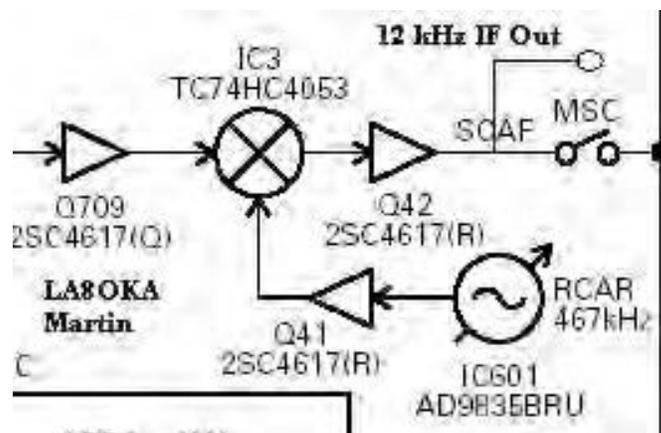
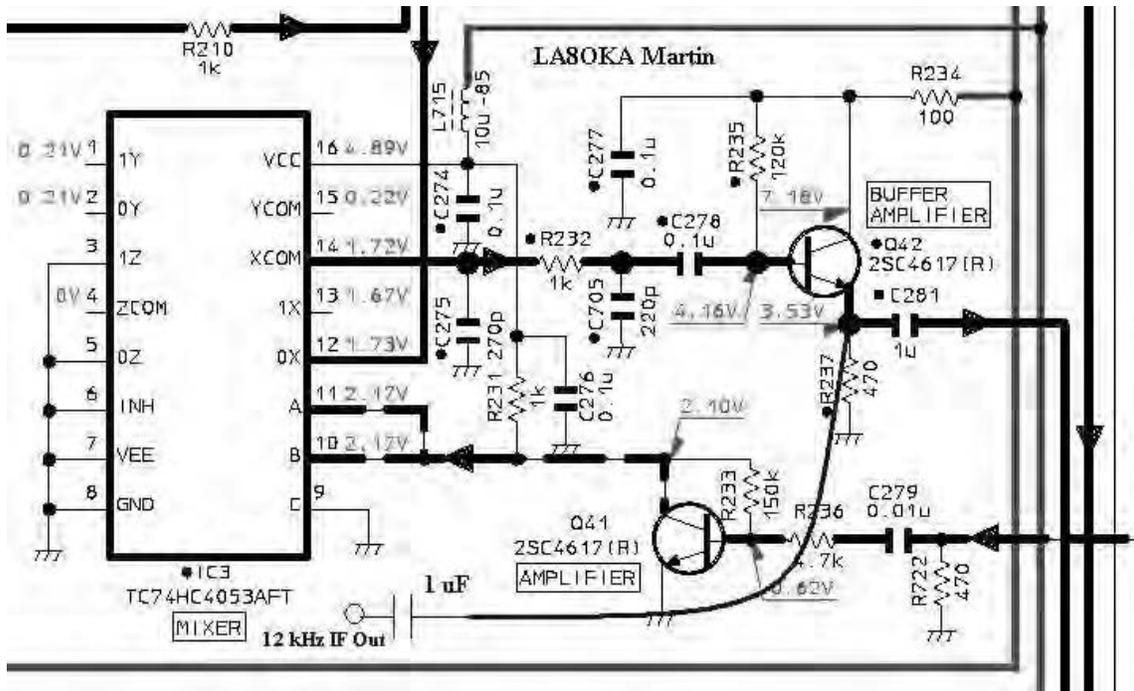
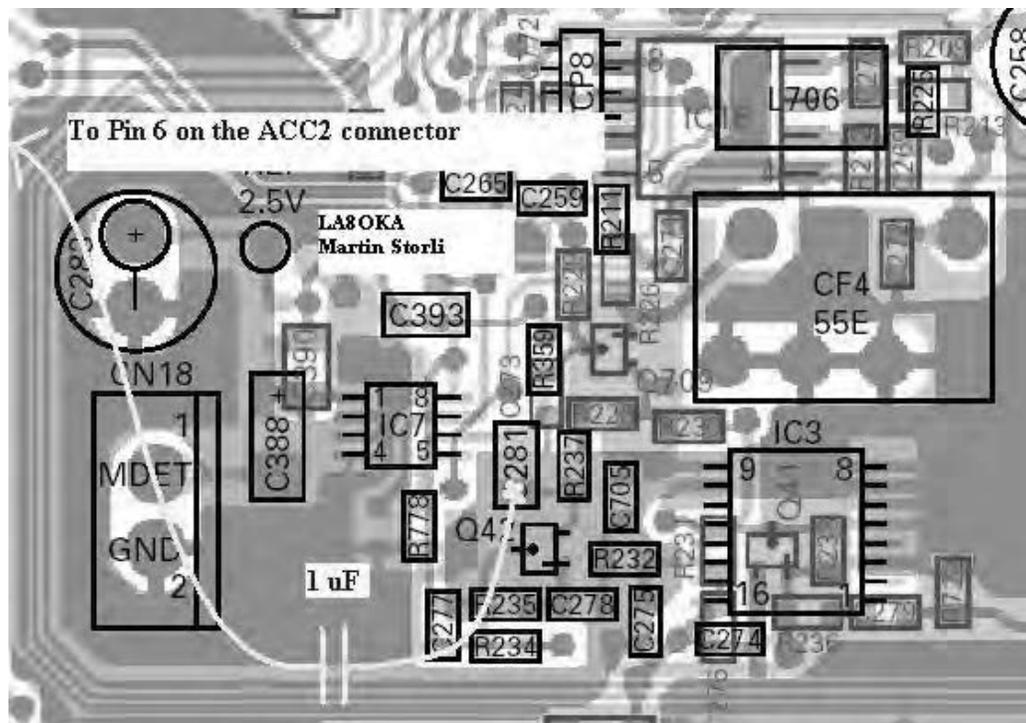


Fig. 1: Block Diagram showing the new 12 kHz IF Output in blue.



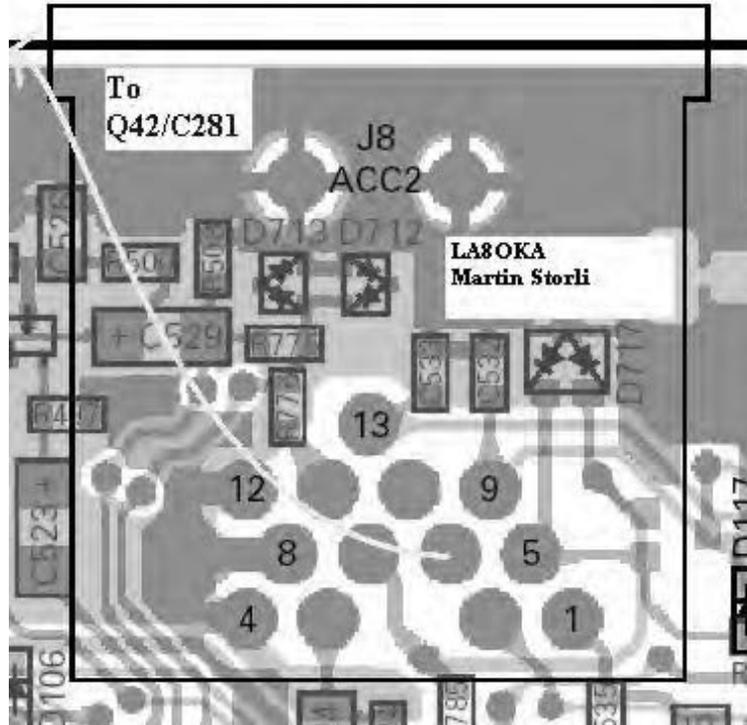
**Fig. 2: Schematic Diagram showing the new 1 $\mu$ F Capacitor and the new 12 kHz IF Output in blue.**



**Fig. 3: The Printed Circuit Board showing the connection point of the 1 $\mu$ F Capacitor. Please note that Fig. 3 is component side view.**

**Locate the surface mounted components, Transistor Q42, Resistor R237 and Capacitor C281.**

- Isolate the leads of the 1  $\mu$ F Capacitor. Solder one of the leads of the 1  $\mu$ F Capacitor on to Capacitor C281 as shown in Fig. 3. Be aware, too much heat will damage Capacitor C281 and the Printed Circuit Board! Make sure that the leads of the 1  $\mu$ F Capacitor does not connects to any other components.
- Solder the center conductor of a RG174 coax cable on to the free lead of the 1  $\mu$ F Capacitor.



**Fig. 4: The Printed Circuit Board showing the connection point at Pin 6 on the ACC2 Connector. Please note that Fig. 4 is foil side view.**

- Stretch the coax cable to the ACC2 Connector.
- Locate Pin 6 on the back of the ACC2 Connector, use a multi-meter to do this. Pin 6 can be reached from the back of the ACC2 Connector. There is no need to remove the TX-RX1 PCB and turn it around, although this will make a better looking modification.
- Solder the center conductor of the coax cable on to Pin 6 on the back of the ACC2 Connector.
- Locate Pin 4 on the back of the ACC2 Connector, use a multi-meter to do this. Pin 4 can be reached from the back of the ACC2 Connector.
- Solder the braid of the coax cable on to Pin 4 on the back of the ACC2 Connector.



**Fig. 5: The ACC2 Connector.**

- You will now have a 12 kHz IF Output at Pin 6 on the ACC2 Connector on the back of your TS-2000 transceiver.
- Put your TS-2000 transceiver back together, connect the power supply and the antenna and enjoy.

Good luck!

73 de LA8OKA Martin Storli