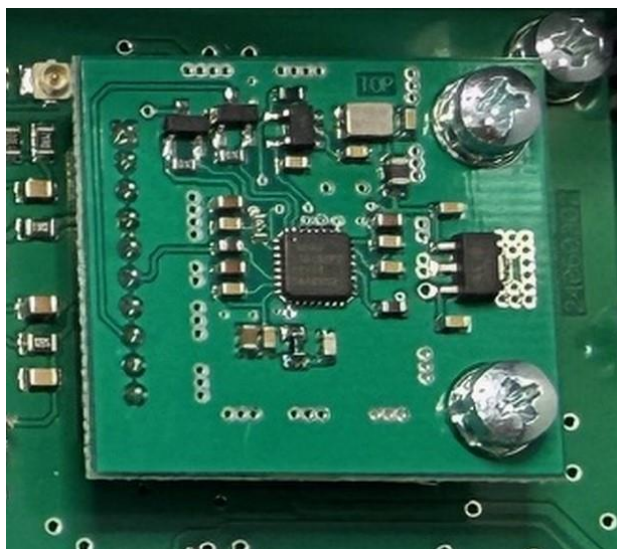


RGO ONE Audio DSP filter (AF) option

Operating/installation manual



1. Introduction

Audio DSP filter for RGO ONE is located right after 9MHz product detector. It benefits further improvement/processing of the incoming signal. AF unit is built around Analog Devices Sigma studio processor ADAU-1761.

AF DSP unit utilizes 12 low pass and 7 high pass 6th order Butterworth filters – selected by the firmware, based on and following IF bandwidth. If narrow 4 pole Jones filter is not engaged the firmware of the radio takes bandwidth from first roofing filter - 2.3, 2.7 or 2.8kHz. When the narrow filter is selected - then the firmware follows bandwidth of the filter position B01 – B10. It also takes into account CW pitch so incoming signal is in the center of both IF and AF filters. Difference between ON and OFF (bypass) of AF board is easily discerned by the high pitched "hiss" which is totally missing when the AF board is switched on. It is no coincidence that the user gets the impression that when the AF module is turned on, the receiver's sensitivity is improving significantly. This is undoubtedly confirmed by the operation of APF (audio peak filter) circuitry on CW, where the user can choose between three levels 8, 10, 12db and off.

Audio Filter board with its proper High/Low pass filter switching also helps to recover the signal shape - previously and inevitably distorted by fast acting IF AGC (receiver

auto gain control) circuitry. So now CW signal is more pleasant and less fatiguing to listen to.

2. AF operation.

2.1. Menu 42 AF On/Off

On - Audio filter board is switched on and all functions are active

Off – Audio filter board is bypassed and no filtering nor other processing is done.

Make sure optional AF board is in its place (See 3. Module installation). If optional AF board is not installed menu entries 42 - 45 will be active.

2.2. Menu 43 CW TUNE / Auto tune feature

Menu parameters: Off, On, and Auto

CW tune/Auto tune (ZERO beat or CW pitch match) is operator aid feature that gives opportunity for the operator to be confident that the tuned frequency matches the frequency of the incoming CW signal. If this menu parameter is On RIT/XIT LED indicator flashes with green light when VFO is tuned exactly on incoming CW signal (matches pitch in menu 19). Minimum signal strength for activating the CW tune indicator is -121dbm (S2).

If Autotune parameter is selected then VFO could be auto-adjusted to the frequency of incoming CW signal. To start auto tune procedure click on RIT/XIT encoder knob. CW Auto tune is possible if the current VFO frequency is less than $\pm 100\text{Hz}$ away from incoming CW station signal. A single high-pitched beep is heard when Auto tune is successful and RIT/XIT LED will glow green on incoming CW signal. If Auto tune procedure is not successful a double high pitched beep is heard. Auto tune won't work if the signal is more than $\pm 100\text{Hz}$ away from current VFO frequency.

2.3. Menu 44 NR noise reduction function.

NR (noise reduction) function is based on ADI noise removal digital algorithm. Adjustable level of action.

Menu parameters: Off, -5db, -10db, -15db, -20db, -25db, -30db

Operator selects 6 levels of noise reduction and off. Greater values will suppress noises but also will distort incoming signal. A proper level should be set for good signal readability.

2.4. Menu 45 APF - Audio Peak Filter

Menu parameters: Off, 8db, 10db, 12db

Audio peak filter is very neat CW aid function that makes incoming signal to "pop up" on the surrounding QRM/QRN. The filter is based on shelving/parametric high Q audio filter centered at pitch frequency ($\pm 30\text{Hz}$). Filter gain should be properly selected by operator in order to mitigate "ringing" effect. Filter is very effective even on lowest gain - 8db. If your firmware version is 1.04 and up there is fast activating/deactivating button. Long press FLT button will toggle switch on/off APF function. Gain of the APF will be set at the last adjusted level in menu 45 (default gain is 8db). This function will work properly only if receiver frequency is exactly tuned to incoming CW signal.

2.5. Menu 46 NOTCH function.

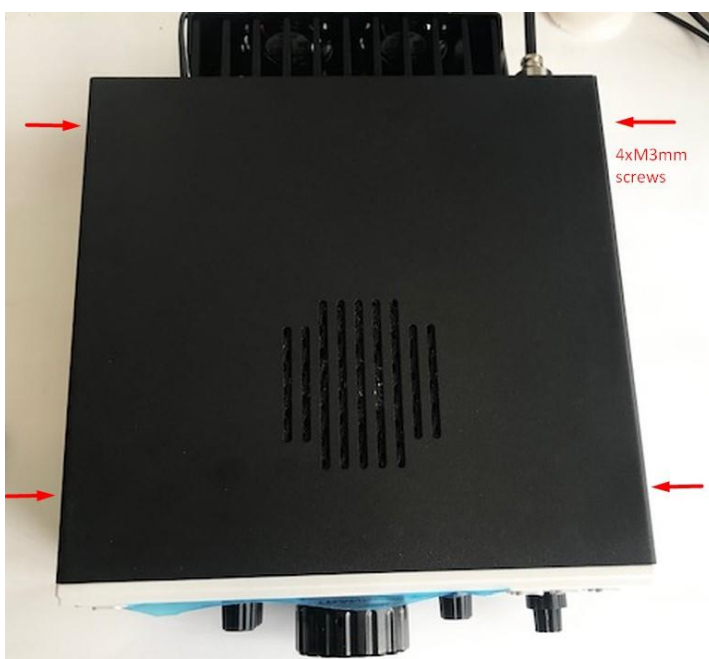
Menu parameters: Off, On, Auto

Parameter On - Manual notch adjustment - rotate enc.3 (RIT/XIT) to suppress the unwanted continuous CW signal. Chevron indicators on LCD will show relatively notch filter position among the audio bandwidth. Fine tune can be performed if 1Hz step tuning is enabled (FST button).

Parameter Auto - Notch filter will be auto tuned to the unwanted beat/cw tone. Long press RIT/XIT encoder to activate auto notch feature.

3. Module installation. *Please switch off power supply and disconnect power cord.*

3.1. Unscrew 4 black screws and lift top cover. Disconnect speaker connector if needed.

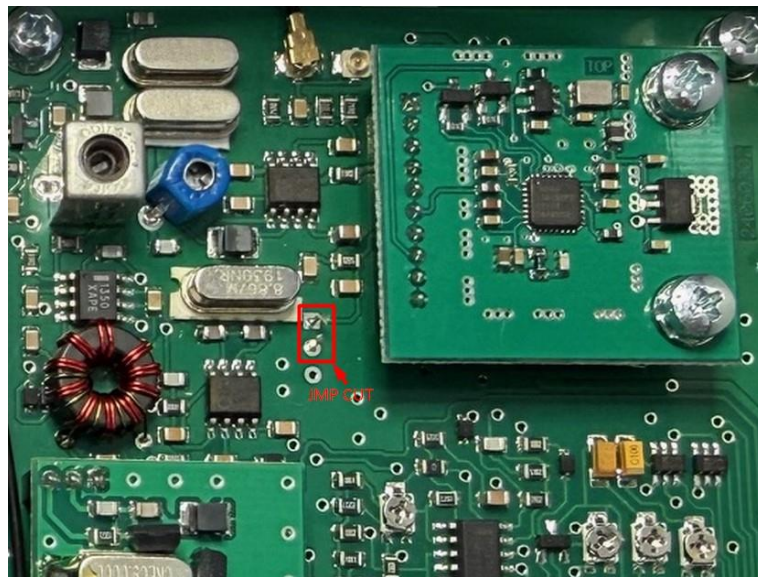


3.2. Locate IF/AF board – on the right side of shielded board RF MIXER.

- 3.3. Locate the place of AF unit – on two round brass standoffs and one 10 pin black connector.



- 3.4. Remove (desolder or cut) jumper JMP1 on IF/AF board, located near 8,867MHz crystal.



- 3.5. Place AF optional board same way as shown on the picture.

Note: Carefully align the module on its place. Board pin header must mate corresponding socket on IF/AF board! Failure to do this may destroy AF and other circuitry.

Secure the board with supplied M3mm screws and lock-washers.

- 3.6. Place top cover, connect the speaker (if disconnected) and secure with 4 black screws.

4. Theory of operation

Schematic diagram of AF unit is shown on fig.1. It is built around ADAU1761BCZP – Analog devices DSP sigma processor. Main DSP routine boots on power on from radio microcontroller via dedicated I²C serial bus.

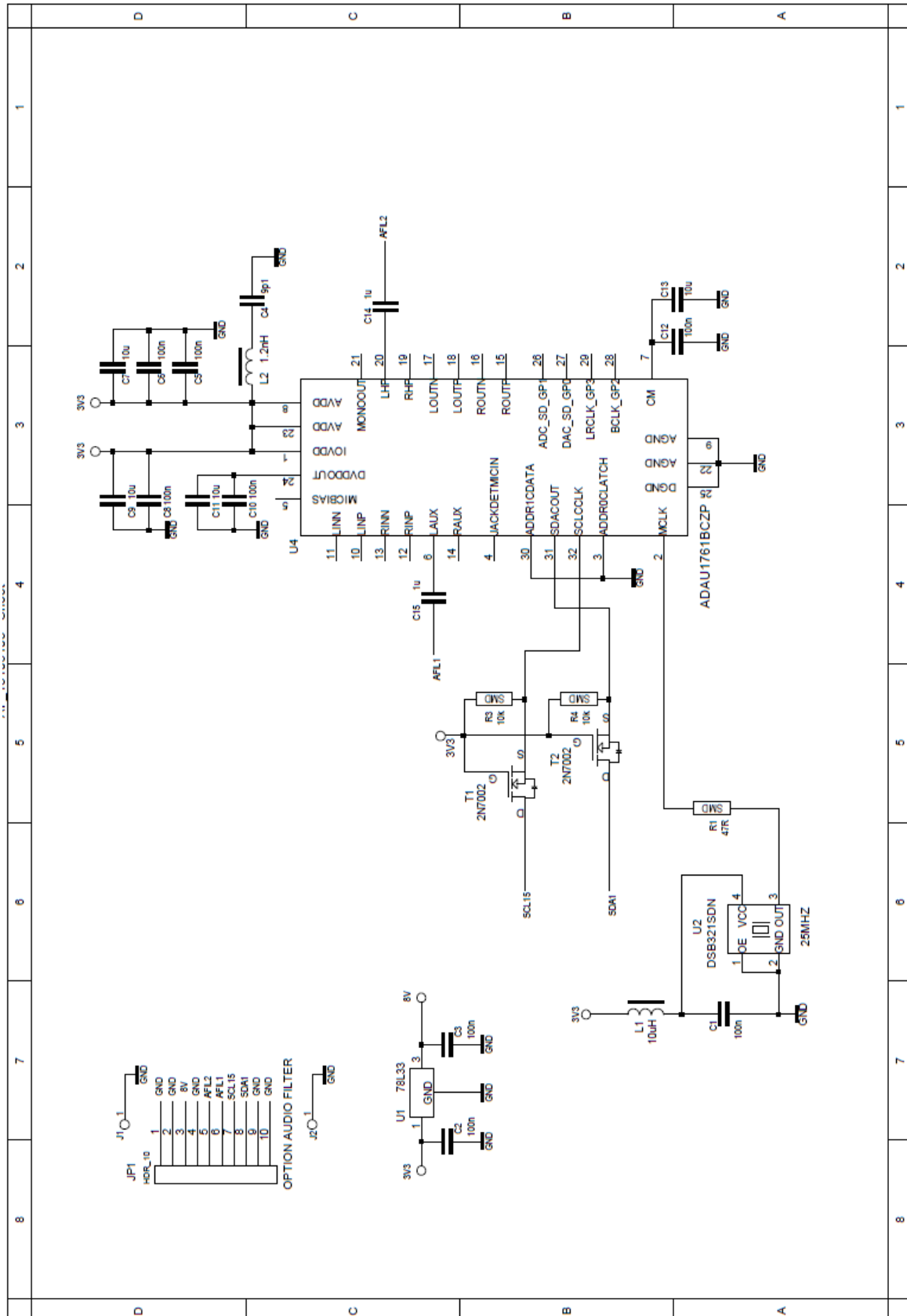


Fig.1

Main DSP routine consists of the following modules:

- 12 Low pass 6th order Butterworth digital IIR filters
- 7 High pass 6th order Butterworth digital IIR filters
- ADI algorithm noise removal block
- High Q notch IIR filter. Filter coefficients are calculated by the firmware.
- Goertzel algorithm tone detector.

Main microcontroller continuously controls parameters and DSP registers according to radio firmware and operations.