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***Modification of the QRP Labs QCX CW  
Transceiver - CW Filter Bypass to Receive  
Transmissions in WSPR Mode***

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# I. Abstract

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## A. Introduction & Motivation

The QRP Labs QCX CW Transceiver (QCX) is an affordable, single-band, 5 watt transceiver kit available for the 17, 20, 30, 40, 60, and 80 meter bands. In its completed state, the QCX is capable of both transmit and receive on CW (Morse code) and it also contains a beacon mode which is capable of supporting both CW and Weak Signal Propagation Reporter (WSPR). Of particular note, the QCX, in its published design, is **only** capable of transmitting on the WSPR network and it is not able to receive on the WSPR mode.

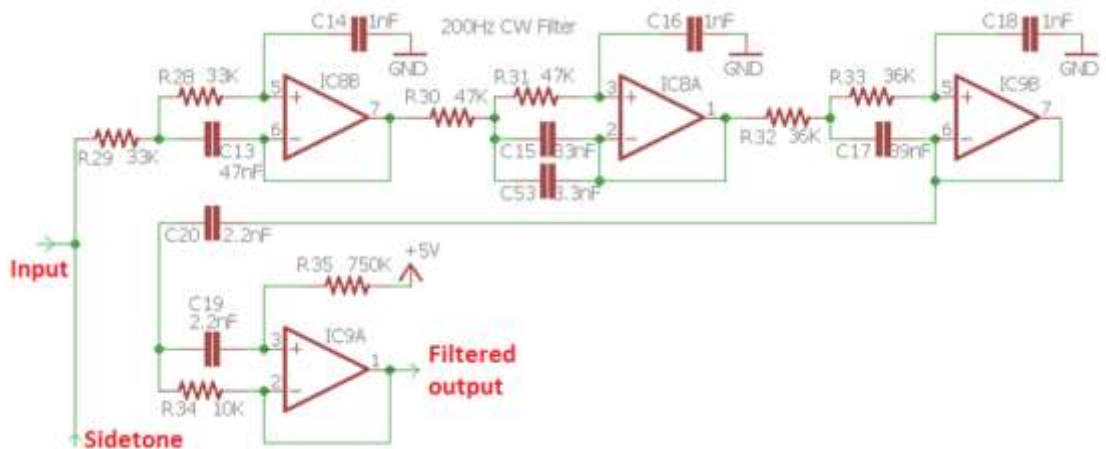
One of the main attractions of the QCX is its affordability and portability. My main motivation for purchasing the QCX was that I wanted to have a dedicated, fully functional Rx/Tx beacon station on WSPR mode for a low price. My goal was to participate fully in the WSPR network as both a transmitter beacon probing propagation paths and band conditions in addition to reporting spots of other radio operator's transmission for automatic upload to the WSPR database via the internet. Observations uploaded to the WSPR database, in addition to benefiting individual operators in their propagation analyses, are used in their aggregate by scientists to better understand the ionosphere and its interaction with other earth and space phenomena.

This Project Note is a summary of the modification I made to the internal circuitry of the QCX transceiver which allowed me to receive in WSPR mode. This modification was made to a completed and working QCX transceiver and involved de-soldering some components which I had previously installed. I would like to acknowledge to N6GN who helped me troubleshoot my QCX kit and who helped me pinpoint and understand the modification described in this project note.

## B. Overview of Design Specifics Limiting Receive Capability on WSPR

The QCX Transceiver contains a 200Hz audio analogue CW filter. Operating in CW, the CW audio filter is designed to produce a 700Hz signal. As such, the CW Tx/Rx frequency range in the transceiver is a 200Hz band around this reference frequency. This CW filter however is limiting for receiving signals in WSPR mode which covers a frequency range of 200Hz around a center frequency of 1,500Hz.

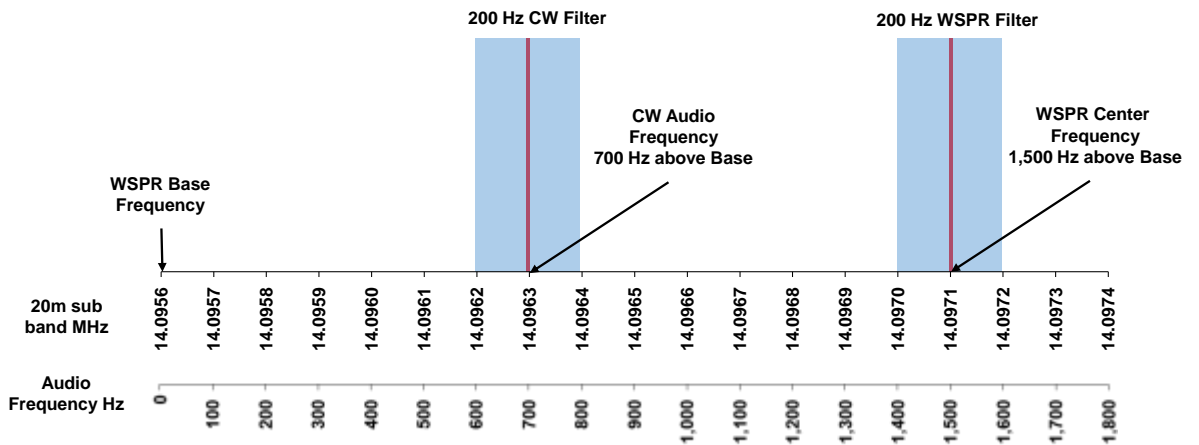
**Figure 1: QCX 200Hz CW Filter**



Source: QRP Labs

The presence of the above CW filter down-converts the frequency of the incoming signals to produce a tone of 700 Hz (+/- 100Hz), a common range for CW operation. This filter however does not allow for higher frequency tones, like those of WSPR mode at around 1,500Hz.

**Figure 2: Audio Frequency range of CW vs WSPR modes**



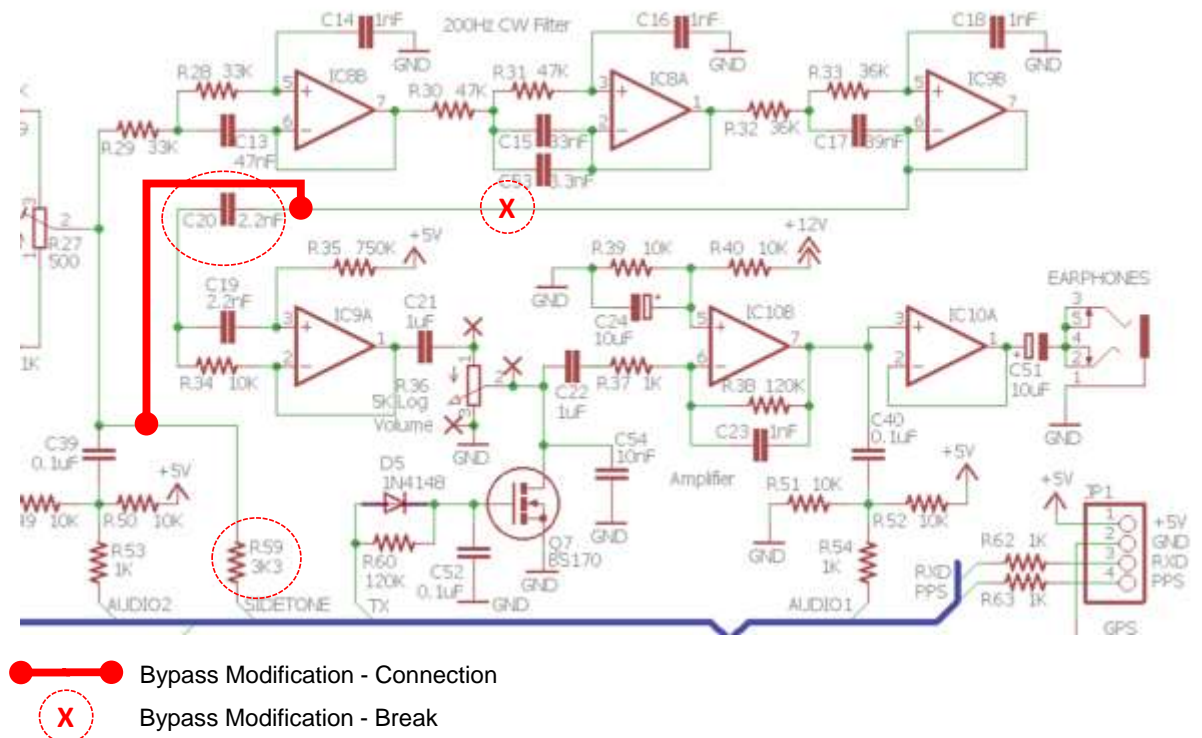
The figure above illustrates the limitation that the 200 Hz CW filter poses for WSPR Rx; the designed configuration permits down-converted tone in a range of 600 to 800 Hz but WSPR mode requires a tone at a higher frequency in the range of 1,400 to 1,600 Hz.

## II. Modification

### A. CW Filter Bypass Modification

The version of the QCX that this modification applies to is the PCB Rev 4 produced in 2018. The bypass of the CW filter and subsequent connections are detailed in the cut-out of the Schematics below.

Figure 3: CF Filter Bypass Modification Schematics

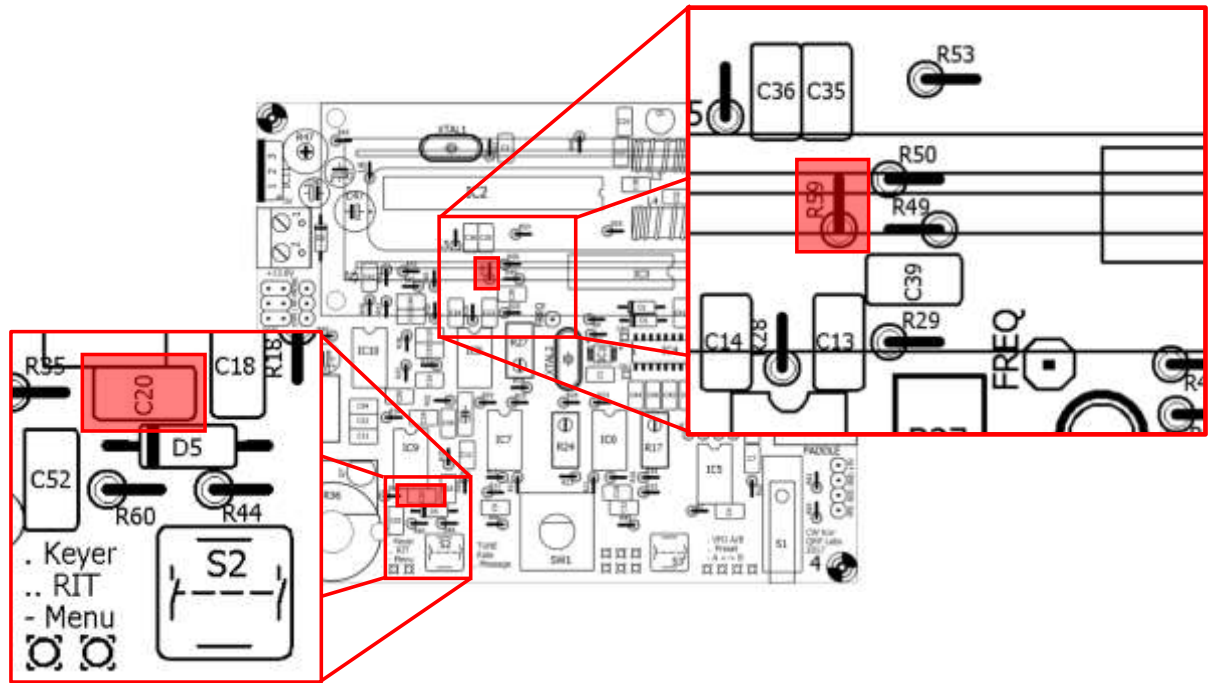


Source: QRP Labs with overlay by Maxwell Moran, W3LLA

This modification bypasses the filter and reroutes the signal directly to the audio amplifier. The modification requires a break in the connection denoted by the encircled "X" with the addition of a new connection between R59 (2.2nF) and C20 (2.2nF). It should be noted that this modification effectively disables the CW filter for CW receive transmission which will degrade reception. A switch could be added to allow the user to toggle between fully function Rx/Tx CW mode and the now fully

functional Rx/Tx WSPR beacon mode. The figure below indicates the relevant components for this modification. R59 is a common node was chosen for its accessibility on the circuit board.

**Figure 4: CF Filter Bypass Modification Highlighted Components**



Source: QRP Labs with highlights provided by W3LLA

In order to perform the modification, the following steps should be made:

1. Change the orientation of the R59 Resistor by 180 degrees such the vertically positioned body wire end is attached to the PCB from the hole closest to C35 with the long wire folded over and inserted into the hole closest to C13. You will be connecting the folded over wire lead to a wire and this orientation allows you to access the hole without interference from the resistor body.
2. Remove the right most wire from C20 from its hole entirely. This hole is the one closest to C20. This wire will not be inserted back into the hole while the left wire will remain in its position.
3. Connect the loose right end wire from C20 to one end of a jumper wire (approx. 2 inches long).
4. Connect the other end of the jumper wire to the hole shared by the R59 long wire (e.g. the R59 hole closest to C13)

**Figure 5: R59 with Orientation Changed (left) and jumper attached (right)**



**Figure 6: C20 with one end connected to PCB and the wire attached to lead (left) Completed Modification (right)**

