Notes on the Softrock RXTX v 6.2 20/30M Daughter Board.

The crystal should be specified as a fundamental series resonate device at what ever make tolerance desired. Note: the Butler oscillator operates on the fundamental frequency which is slightly different than 3rd overtone. I have no idea what drive level is present, but stay in HC-49 case, if at all possible, as this is the largest quartz blank.

The Butler oscillator uses the “tuned” tank circuit to extract the third harmonic and provide the balance of the phase shift and gain required to sustain oscillation. The “tuned” circuit needs to resonate higher than the third harmonic to meet the operating conditions and usually is not critical [often why swamped with a resistor]. The circuit will also work with a fundamental crystal but at a higher crystal drive current. In both cases the actual operating frequency will be somewhat higher than the actual series resonant frequency. So use a frequency counter [or radio] to determine the exact frequency.

The series resonant frequency of a crystal is always lower than the parallel resonant frequency. Parallel resonant crystals are correlated with an external parallel capacitor across the crystal, usually 18pF, 20pF or 32pF. The higher the external cap, the lower the anti-resonant [parallel resonant] frequency will be. Oscillators always operate between the series and loaded anti-resonant frequencies. [Exception: If there is an external inductor, it will move the series resonant frequency lower]

It is quite simple to measure the two frequencies of a crystal with minimum equipment. A stable 50 ohm signal generator or DDS and a rf meter [a receiver, RF Voltmeter or an rf probe if you have a large enough signal]. Take 2 resistors from 1K to 10K and connect together in series. Connect one end to the generator and the other to the meter. Connect one lead of the crystal at the center and the other to the shields [gnd] of the generator and meter. As you manually sweep the generator through the series resonant frequency of the crystal there will be an 80 to 100 db drop in amplitude about 5Hz wide at the series resonant frequency - so go slow. If you put the crystal in series with the resistors the same effect will be observed at a somewhat higher frequency when the elements are parallel resonant and block the signal. A 20pF cap in parallel with the crystal will lower the frequency to the 20pF correlation frequency. The resistors serve to isolate the external strays and give very reliable readings. The anti-resonant null is much broader than the series resonant due to the effects of circuit Q.