Robert F. Cann W4GBB
1606 Lochwood Dr.
Richmond VA 23233

CB to 10

—part XVI: a CW conversion

Change one crystal and work the world legally with 5 Watts.

With three years of operating 10 meter QRP using converted CB rigs behind me, I decided to look for ways to monitor band openings by taking advantage of the CW beacons around the world. At the same time, 10 meter CW sounded like a lot of fun. In order to accomplish these goals, I established the following criteria which I wanted incorporated into the finished product:

1. 10 meter beacon coverage;
2. CW transmit capabilities on both General and

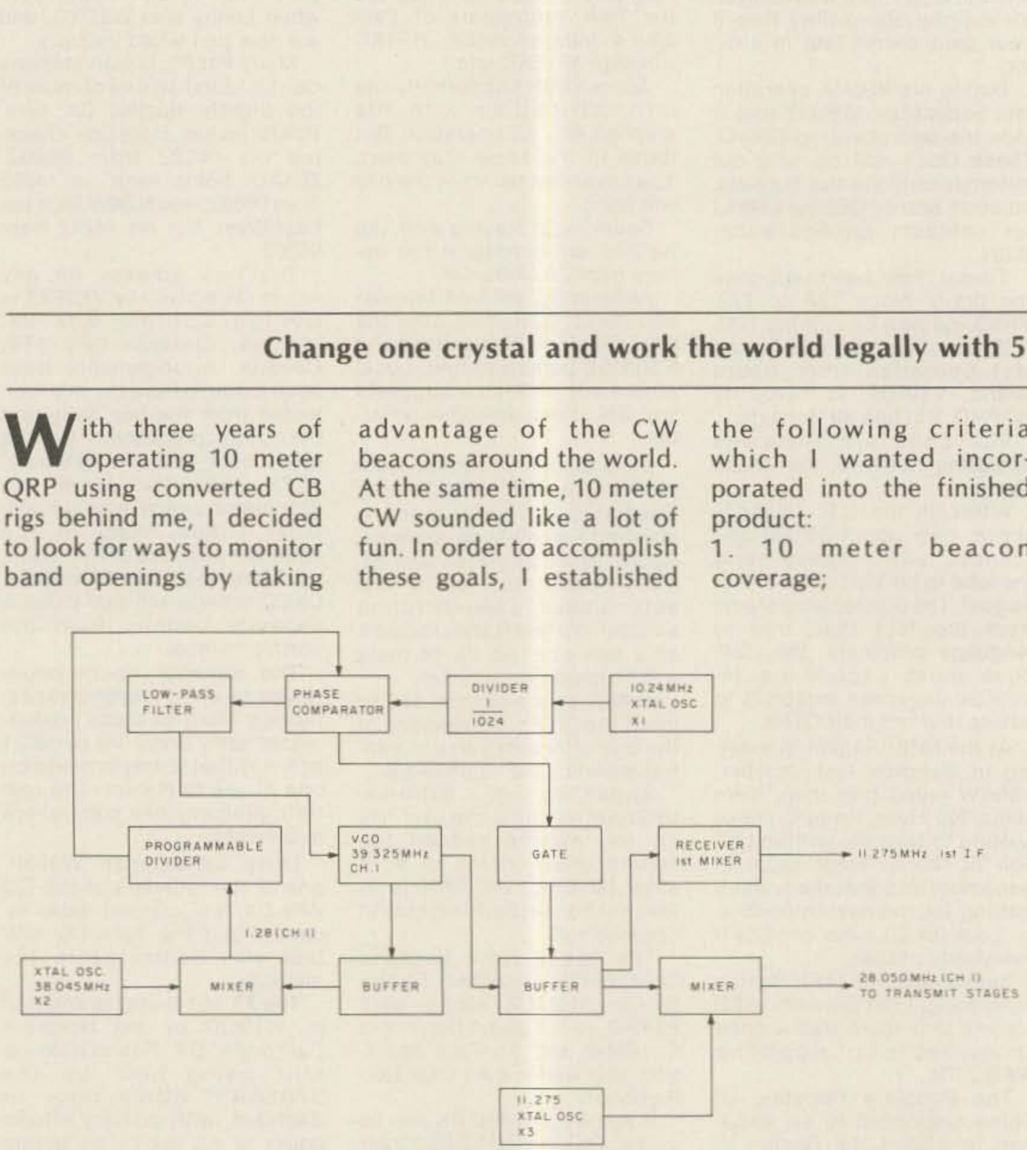

Fig. 1. Block diagram of phase-locked loop circuitry in the Sharp CB-800A with frequencies indicated for 10 meter coverage.

Ch.	fo	fvco	÷n
1	28.050	39.325	1.28
2	28.060	39.335	1.29
3	28.070	39.345	1.30
4	28.090	39.365	1.32
5	28.100	39.375	1.33
6	28.110	39.385	1.34
7	28.120	39.395	1.35
8	28.140	39.415	1.37
9	28.150	39.425	1.38
10	28.160	39.435	1.39
11	28.170	39.445	1.40
12	28.190	39.465	1.42
13	28.200	39.475	1.43
14	28.210	39.485	1.44
15	28.220	39.495	1.45
16	28.240	39.515	1.47
17	28.250	39.525	1.48
18	28.260	39.535	1.49
19	28.270	39.545	1.50
20	28.290	39.565	1.52
21	28.300	39.575	1.53
22	28.310	39.585	1.54
23	28.340	39.615	1.57

Table 1. $f_o + 11.275 = f_{vco}$; $f_{vco} - 38.045 = n$.

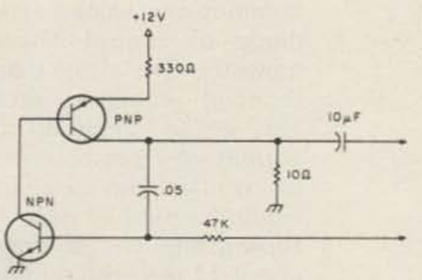

Fig. 2. Sidetone oscillator circuit. Transistors can be any general-purpose audio types. The .05 uF capacitors may be changed to vary the tone.

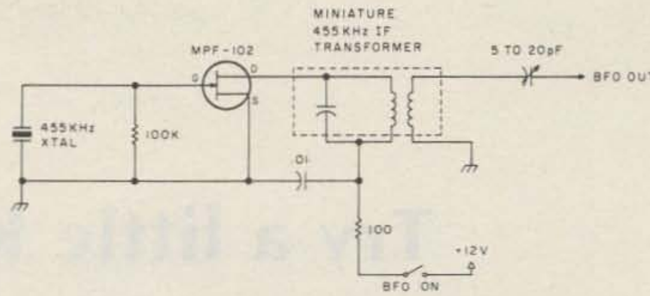

Fig. 3. 455-kHz bfo circuit.

Novice frequencies;
3. QRP operation of 5 Watts or less; and
4. price range between $30 and $40.

After researching the market, I decided on the Sharp model CB-800A phase-locked loop AM transceiver, which was readily available in my area for a price well under forty dollars.

An examination of the service manual for the CB-800A indicated that I would be able to meet the above goals. The frequency coverage I decided upon is shown in Table 1 with the beacon frequencies and identifications listed below:

Ch. 9	28.150 WA1EOB
Ch. 10	28.160 PY1CK
Ch. 11	28.170 ZL2MHF
Ch. 12	28.190 3B8MS
Ch. 12	28.190 DLØIGI
Ch. 13	28.200 JA1GY
Ch. 14	28.210 N4RD
Ch. 15	28.220 GB3CX

The first step in the conversion is to review the PLL frequency generation as shown in Fig. 1. As can be seen, the vco stage is the heart of the unit. In the original circuit, a vco frequency of 38.240 MHz was mixed with a received frequency of 26.965 MHz (Ch. 1) to produce a first i-f frequency of 11.275 MHz.

In the transmit mode, the vco output was mixed with an 11.275-MHz crystal oscillator to produce the 26.965-MHz transmit signal for channel 1. From this information, we can generate a formula to determine the vco frequency to enable us to transmit and receive on 28.050 MHz for channel 1. Thus, $f_o + f_{i\text{-}f} = f_{vco}$, where f_o is the operating frequency and $f_{i\text{-}f}$ is the frequency of the first i-f. With an operating frequency of 28.050 MHz for channel 1, the vco frequency must be changed to 39.325 MHz. It is very important, when converting a PLL circuit, that the original division factor for the programmable divider be maintained. As can be seen in Fig. 1, the division factor for channel 1 is 1.28. By changing the frequency of the original 36.960 MHz crystal (X2), we can do this. Thus, $f_{vco} - 1.28 =$ 38.045 MHz, the new frequency of X2.

With the new 38.045 MHz installed, perform the following steps to align the PLL circuit:

1. Place the channel selector switch to channel 12.
2. Connect an rf voltmeter to C220 at the output of Q206, and tune T203 for maximum output at 38.045 MHz.
3. Disconnect the rf voltmeter.
4. Connect a frequency counter to TP206 at the output of the vco transistor, Q203, and tune T201 for 39.465 MHz.
5. Disconnect the frequency counter.
6. Connect an rf voltmeter to TP2 at the output of the vco buffer transistor, Q202, and tune T202 for maximum output at 39.465 MHz.
7. Disconnect the rf voltmeter.
8. Connect a frequency counter to pin 15 of IC203, and verify the existence of a 1.42-MHz input signal.
9. Disconnect the frequency counter.
10. Measure the dc voltage at TP206. A voltage of approximately +2.7 indicates that the PLL circuit is locked. Zero indicates an unlocked condition.

This completes the PLL alignment. The receiver circuit alignment is as follows:

1. With the channel selector switch in the channel 12 position, connect a 28.190-MHz signal to the antenna jack.
2. Tune transformers T1, T2, and T3 for maximum S-meter indication.
3. Disconnect the signal generator.

This completes the receiver alignment. The transmitter alignment is as follows:

1. Connect a 50-Ohm dummy load to the antenna jack.
2. With the channel selector switch still in the channel 12 position, key the transmitter and tune T302, T303, T304, L302, and L303 for maximum rf output.
3. With a frequency counter, verify that the transmitted frequency is 28.190 MHz.

This completes the transmitter alignment, and you are now ready to make the necessary modifications for CW operation. The first step is to establish a method for keying the transmitter. This is accomplished by disconnecting the wiring to the existing PA switch located on the squelch control. Use this switch to energize the T-R relay in the CW mode. Unground the emitter resistor of Q303, the first rf amplifier in the transmitter, and connect it to the now-unused PA speaker jack. This will be the keyer connection. One word of caution: The ground side of the PA speaker jack is connected to the chassis. Before making any connections to the jack, break the connection to the chassis and connect the ground side of the jack to the circuit board ground.

The sidetone oscillator circuit shown in Fig. 2 and the receiver bfo circuit shown in Fig. 3 work very well and are small enough to fit inside the rig with no external mounting necessary. The output of the bfo circuit is high enough so that no direct connection to the receiver i-f is necessary. I simply positioned the wire from the bfo output across IC1, the receiver i-f circuit. Remember that in both the sidetone oscillator and the bfo circuit, ground connections are to the circuit board ground and not to the chassis ground.

Whether you decide to use the rig as a beacon monitor or a QRP rig, you will find it very enjoyable. I have had many contacts with it and all with good reports of CW quality.

So trade in your mic for a key and have fun on 10 meter CW!■