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CB to 10

—part XX: converting the Royce I-655

Shortly before the deadline for the sale of 23-channel CB sets, a local department store ran a special sale to get rid of an overstock of the Royce 23-channel sets. Since the price was so low, I could not resist buying one of the Model I-655s. Although I didn't know exactly what I would do with the thing, I thought the PLL synthesizer was worth at least the purchase price of the unit.

The radio sat in the closet until I saw an ad in *73 Magazine* for conversion kits to put CB sets on 10 meters. Unfortunately, after checking the catalog of kits, I found that none was available for the I-655. The company offered to make a special kit for a $15.00-an-hour engineering fee, but, although this is a reasonable fee, it easily could have cost me more than for the rig itself.

Not easily discouraged, I sent a letter to Royce requesting information on the PLL unit. I received a brief, but polite letter informing me that the unit was sealed and no information was available. Being told this was enough to prompt me to tear into the unit and convert it myself. The project turned out to be extremely easy and straightforward. I will describe now the conversion procedure used on the rig.

It is worth mentioning that the Royce is not the only CB that uses this particular PLL unit. The I-655 is a 23-channel set, but the PLL unit itself is capable of generating 64 ten-kilohertz channels due to the 6-bit binary input that sets the divider chain. I imagine the unit is also used in the newer 40-channel sets as well. By adding only one SPST switch, the extra channels available on a converted 40-channel unit may be obtained on the cheaper 23-channel units.

The block diagram included with my I-655 indicated the rig has three oscillators: 37.38 MHz, 10.24 MHz, and 10.695 MHz. When I opened the unit I found a 36.190 MHz oscillator instead of the indicated 37.38 MHz one. I do not know why the diagram is wrong, but if your unit has the 36.190 MHz crystal, the conversion will work. I cannot say what the results would be on a unit with the oscillator frequency indicated on the block diagram—so be careful.

In order to work on the PLL unit, you must first remove the box that encloses it (I guess this is what is meant by sealed unit). The box is removed by unsoldering the two ends and then snapping it off. Once the cover is removed, you should see a 36.190 MHz crystal roughly in the center of the PC board. Directly below the crystal is an adjustable coil of the metal can type. The two 10-MHz crystals are off to either side. Each oscillator has a trimmer capacitor to touch up the crystal frequency. You will adjust only the coil and trimmer for the 36 MHz crystal, so do not touch the others.

The new crystal frequency is simply 36.190 MHz + the amount you wish to move the transceiver up by. Since I converted my set according to the *73* plan, I moved it exactly 2.0 MHz, giving a new crystal frequency of 38.190 MHz. I ordered my crystal from Jan Crystals, and they were quite helpful in providing the necessary correlation information for me. Table 1 gives the information needed to order a new crystal. Using the 2.0 MHz shift gives coverage from 28.965 MHz (channel 1) to 29.255 MHz (channel 23). If you in-

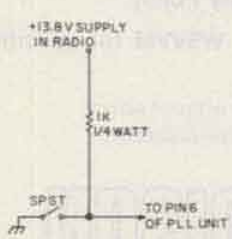

Fig. 1. The switch is closed for normal operation, open for extended frequency operation. (See text.)

Crystal frequency: 38.190 MHz
Type: Third overtone
Holder type: HC-18/U
Equivalent series resistance: < 30 Ω
Load capacitance: 25 pF
Tolerance: 0.0025% or better
Temperature: 25° C (non-oven)

Table 1. Crystal correlation data for the Royce I-655 PLL unit. The indicated crystal frequency moves the output up by 2.0 MHz.

stall the range-extending switch, you will have coverage to 29.575 MHz. The frequencies generated are listed in Table 2 for reference.

Once you obtain the new crystal, solder it in where the original crystal was and connect the rig to a dummy load. When you key the radio, you will have no output. This is because the drive is cut off if the PLL is not locked up. With the rig keyed, carefully adjust the coil directly below the new crystal. At some point the output meter will suddenly jump up, indicating the unit has locked. You will probably need to adjust the coil slightly more in order to get lock over the entire range of available frequencies. My unit would lock over the entire expanded frequency range with no problems.

There are two coils at the end of the PLL board nearest the front of the radio that should be touched up for the best output at midband. In order to set the operating frequency exactly, you will need to couple a counter to the output by an appropriate means, and adjust the trimmer for the 38-MHz oscillator to put you on the right transmit frequency. This also will take care of the receive frequency.

Tuning the transmitter and receiver strips are a bit tricky in the I-655, due to the mounting configuration of the PC boards. Since the individual boards are mounted at right angles to the main PC board, you probably will need to make a very short alignment tool to fit the coils. The transmitter board is located next to the PLL unit. There are only three coils to adjust when tuning the transmitter section. These are T401, T402, and L403 on the schematic diagram supplied with the radio. I found that my unit would put about 5 Watts into a 50-Ohm load when properly tuned up. Do not try to adjust L404 since it is fixed (the slug is glued in).

The receiver has only two transformers to adjust in the rf stage. The i-f uses ceramic filters that require no alignment. Using whatever signal source you have, touch up the tuning on T101 and T102. T101 is located at the back of the PC board, above the keying relay. You may want to remove the speaker to adjust T102, since it is partially under the speaker frame. Once you have tuned up the front end, the rig is ready for use. My set checked out with less than 0.3-uV sensitivity for 10 dB (S + N)/N over the entire band.

You might want to add the simple modification to give you the extra channels of a 40-channel rig. As I mentioned before, the PLL unit itself can generate 64 channels. This will cover all the frequencies from 28.965 MHz to 29.605 MHz in 10-kHz steps. Although I did not install the necessary 6 switches to accomplish the full conversion, it is only a simple extension of the single-switch conversion that I will describe. If you install the single switch and use it in conjunction with the channel selector, you will have the 46 channels listed in Table 2. You might want to attach this table to the radio for easy reference.

Turn the radio over and you will see that there are 24 pins which come from the PLL unit and extend through the main PC board. I will refer to these pins as numbers 1 through 24, with number 1 starting at the rear of the radio. Pins 5 through 10 program the frequency of the PLL. On the 23-channel rigs, pin 6 is permanently grounded, disabling the input. To reactivate pin 6, cut the traces on either side of the pin and connect the pin to an SPST switch as shown in Fig. 1. Since you are only switching dc here, you can mount the switch wherever you feel is most convenient. When the switch is closed, the unit operates normally; when the switch is open, the higher 23 frequencies are produced starting with channel 1 on the selector.

If you want to have all 64 channels, simply install six switches in the same manner as given in Fig. 1, one switch for each of pins 5 through 10. With six switches, the channel selector will be nonfunctional and you must program the frequency with the individual switches. It should be an easy matter to make a table of the resultant channels.

I made one final modification that has proven quite useful while operating the rig. I installed a BNC jack on the back of the radio just below the power jack. I coupled the BNC jack to the rf output jack with a gimmick capacitor so that I could monitor the output frequency of the rig.

Although the specific instructions given here are intended for the Royce I-655, they should be broadly applicable to many CB sets which use the same PLL unit. The fact that only a single crystal is needed for the conversion makes the PLL rig a much better value than the heterodyne-type sets requiring several crystals for the same or smaller number of channels. Since the 23-channel PLL sets often can be obtained quite cheaply, this also makes them attractive for conversion when the extra channels can be obtained easily, as I have described. If you opt for the extra channel switch or switches, I would suggest discretion in their use to avoid interference with OSCAR, etc. I will do my best to answer any questions if an SASE is included with your inquiry. ■

Channel Selector	Operating Frequency (MHz) Switch Closed	Switch Open
1	28.965	29.285
2	28.975	29.285
3	28.985	29.295
4	29.005	29.305
5	29.015	29.325
6	29.025	29.345
7	29.035	29.355
8	29.055	29.375
9	29.065	29.385
10	29.075	29.395
11	29.085	29.405
12	29.105	29.425
13	29.115	29.435
14	29.125	29.445
15	29.135	29.455
16	29.155	29.475
17	29.165	29.485
18	29.175	29.495
19	29.185	29.505
20	29.205	29.525
21	29.215	29.535
22	29.225	29.545
23	29.255	29.575

Table 2. Operating frequencies available with normal operation (switch closed) and extended operation (switch open). See text for explanation.