

# Alignment

## Introduction

The **VX-160/-180** has been aligned at the factory for the specified performance across the entire frequency range specified. Realignment should therefore not be necessary except in the event of a component failure. All component replacement and service should be performed only by an authorized Vertex Standard representative, or the warranty policy may be voided.

The following procedures cover the sometimes critical and tedious adjustments that are not normally required once the transceiver has left the factory. However, if damage occurs and some parts are replaced, realignment may be required. If a sudden problem occurs during normal operation, it is likely due to component failure; realignment should not be done until after the faulty component has been replaced.

We recommend that servicing be performed only by authorized Vertex Standard service technicians who are experienced with the circuitry and fully equipped for repair and alignment. Therefore, if a fault is suspected, contact the dealer from whom the transceiver was purchased for instructions regarding repair. Authorized Vertex Standard service technicians realign all circuits and make complete performance checks to ensure compliance with factory specifications after replacing any faulty components. Those who do undertake any of the following alignments are cautioned to proceed at their own risk. Problems caused by unauthorized attempts at realignment are not covered by the warranty policy. Also, Vertex Standard must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners. Under no circumstances should any alignment be attempted unless the normal function and operation of the transceiver are clearly understood, the cause of the malfunction has been clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary. The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting from use of improper test equipment is not covered under the warranty policy. While most steps do not require all of the equipment listed, the interactions of some adjustments may require that more complex adjustments be performed afterwards. Do not attempt to perform only a single step unless it is clearly isolated electrically from all other steps. Have all test equipment ready before beginning, and follow all of the steps in a section in the order presented.

## Required Test Equipment

- Avionics Radio Tester with calibrated output level at 1 GHz
- In-line Wattmeter with 5% accuracy at 1 GHz
- 50-ohm, 10-W RF Dummy Load
- Regulated DC Power Supply (standard 7.5V DC, 2A)
- Frequency Counter:  $\pm 0.2$  ppm accuracy at 1 GHz
- AF Signal Generator
- AC Voltmeter
- DC Voltmeter
- UHF Sampling Coupler
- IBM PC/compatible Computer with Microsoft DOS v3.0 or later operating system
- Vertex Standard CT-42A Connection Cable and CE44 Alignment program

## Alignment Preparation & Precautions

A 50-ohm RF Dummy load and in-line wattmeter must be connected to the main antenna jack in all procedures that call for transmission, except where specified otherwise. Correct alignment is not possible with an antenna.

After completing one step, read the following step to determine whether the same test equipment will be required. If not, remove the test equipment (except dummy load and wattmeter, if connected) before proceeding.

Correct alignment requires that the ambient temperature be the same as that of the transceiver and test equipment, and that this temperature be held constant between 20° and 30°C (68°~ 86°F). When the transceiver is brought into the shop from hot or cold air, it should be allowed time to come to room temperature before alignment.

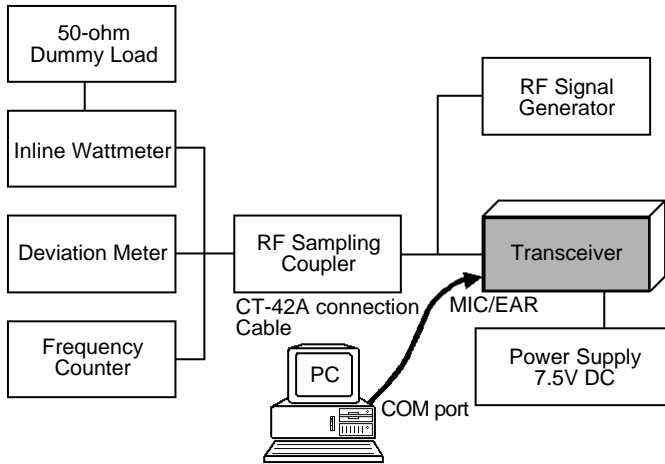
Whenever possible, alignments should be made with oscillator shields and circuit boards firmly affixed in place. Also, the test equipment must be thoroughly warmed up before beginning.

**Note:** Signal levels in dB referred to in this procedure are based on  $0 \text{ dB}\mu = 0.5 \mu\text{V}$  (closed circuit).

### Important Note

When connecting the **CT-42A** plug into the **MIC/SP** jack of the **VX-160/-180**, you must remove the plastic cap and its mounting screws prior to programming. Please remember to re-attach the cap and screws when the programming is complete.

Set up the test equipment as shown below for transceiver alignment, and apply 7.5V DC power to the transceiver.



The transceiver must be programmed for use in the intended system before alignment is attempted. The RF parameters are loaded from the file during the alignment process.

In order to facilitate alignment over the complete operating range of the equipment, it is recommended that the channel data in the transceiver be preset as per the chart below.

Channels	Frequency (MHz)		
	Ver. AS1	Ver. D	Ver. F
Low Band Edge (Channel 1)	400.000	450.000	485.000
Band Center (Channel 2)	415.000	467.500	498.500
High Band Edge (Channel 3)	430.000	485.000	512.000

Channel	Tone-Frequency (Hz) / DCS-code					
	Ver. AS1		Ver. D		Ver. F	
	CTCSS	DCS	CTCSS	DCS	CTCSS	DCS
Low Band Edge (Channel 1)	-	-	-	-	-	-
Band Center (Channel 2)	151.4	-	151.4	-	151.4	-
High Band Edge (Channel 3)	-	627	-	627	-	627

## The alignment tool outline

### Installation of the Alignment tool

The "alignment mode" is a software-based protocol, accessed by an "Alignment Mode" command from the computer while switching the transceiver on. It is operated by the alignment tool automatically. During use of the alignment mode, normal operation is suspended. The alignment tool program provides all needed operation capability.

The alignment tool consists of an executable file "CE44.exe" and an accompanying configuration file "CE44.cfg" which should be loaded per standard DOS procedures. Create a suitable directory, then copy these files from the distribution diskette into the new directory.

For example, if copying the file from Drive A, use the following DOS command sequence:

```
c:\ mkdir align [enter]
c:\ cd align [enter]
c:\ align\ copy a:ce44.*
```

No further installation steps are required. If you wish to utilize a different name for the alignment directory, it will not matter to the executable file.

### Booting the Alignment Tool

Change to the "align" directory (or the directory name you utilized in the previous section). Now type on the command line: ce44 [ENTER] to boot the alignment tool.

The introductory screen will appear, and you may press any key to enter the main screen.

### Entering Alignment Mode

To enter the alignment mode, turn the transceiver off, Select "Radio" then "Adjust" parameter. Now, turn the transceiver back on. When the command has been successful, a message on the computer screen will confirm that the transceiver is now in the "Alignment" mode.

### Alignment Sequence

Although the data displayed on the computer's screen during alignment is temporary data, it is important you follow the basic alignment sequence precisely, so that the displayed data and the data loaded into the transceiver are identical.

#### Basic Alignment Sequence

1. Enter the alignment mode
2. Upload data from transceiver
3. Align data
4. Download data to transceiver

# Alignment

## PLL VCV (Varactor Control Voltage)

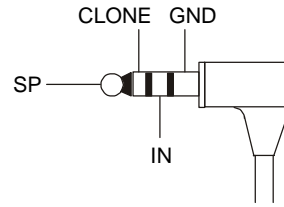
- Connect the DC voltmeter between **TP3** on the Main Unit and ground.
- Set the transceiver to CH 3 (high band edge), and adjust **L1004** on the Main Unit for 4.0 V ( $\pm 0.1$  V) on the DC voltmeter.
- Set the transceiver to CH 1 (low band edge), and confirm the low-end VCV is more than 1.1 V while transmitting, and also while receiving.

## Transmitter Output Power

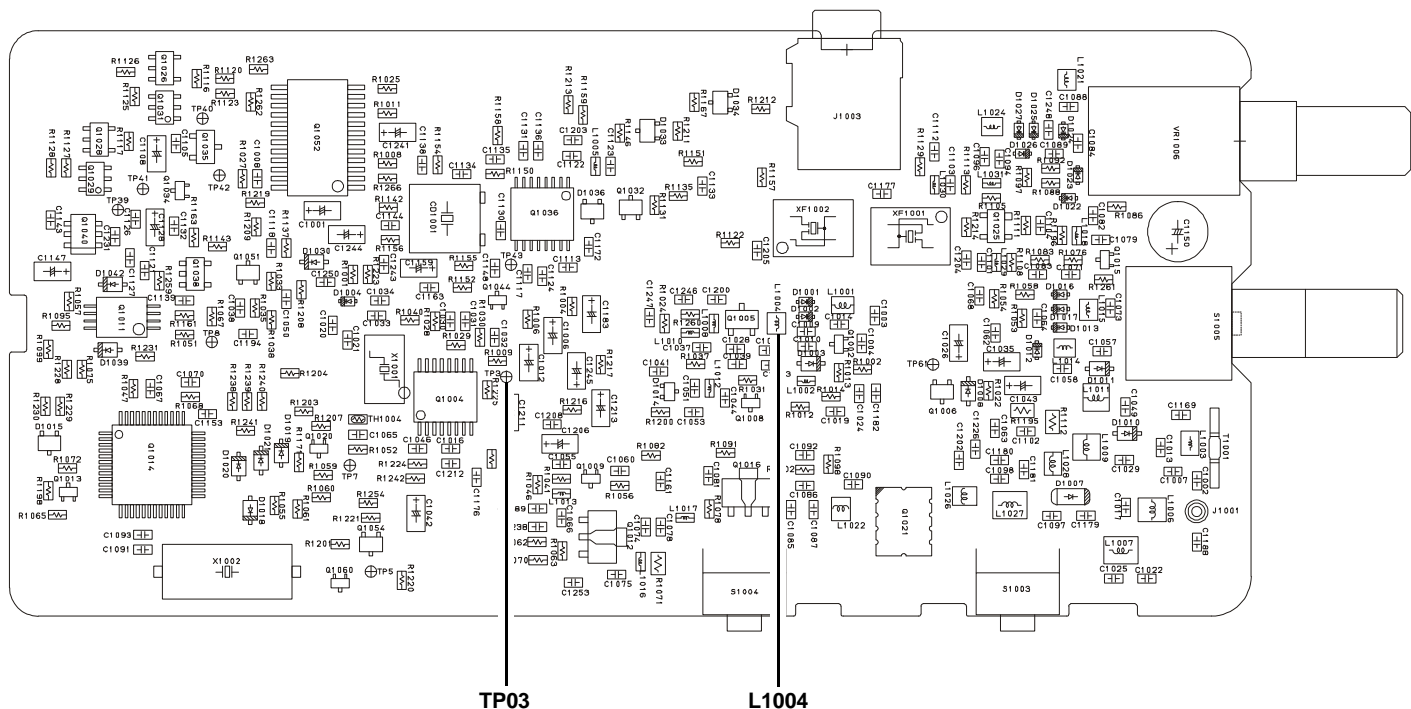
- Set the transceiver to CH 2 (band center).
- Open the “Adjust” window on the CE44 program, then select the “RF Power (High)” or “RF Power (Low)” parameter.
- Press the [ENTER] key to enable programming of this parameter; use the [←] or [→] arrow keys so that the power meter reading is 5.0 W ( $\pm 0.1$  W) (for “RF Power High”) or 1.0 W ( $\pm 0.1$  W) (for “RF Power Low”). Confirm that the current consumption is 2.2 A or lower (for “RF Power High”) or 1.0 A or lower (for “RF Power Low”).
- Press the [ENTER] key to lock in the new data.

## MIC Sensitivity

- Set the transceiver to CH 2 (band center).
- Inject a 1 kHz tone at  $-37$  dBm to the **MIC** jack.



- Open the “Adjust” window on CE44, then select the “MIC Sensitivity” parameter.
- Press the [ENTER] key to enable programming of this parameter; use the [←] or [→] arrow keys so that the deviation meter reading is  $\pm 3.0$  kHz ( $\pm 0.1$  kHz) (for 25 kHz steps) deviation.
- Press the [ENTER] key to lock in the new data.



## MAX Deviation

- Set the transceiver to CH 2 (band center).
- Inject a 1 kHz tone at -17 dBm to the **MIC** jack.
- Open the “Adjust” window on CE44, then select the “MAX Deviation” parameter.
- Press the [ENTER] key to enable programming of this parameter; use the [←] or [→] arrow keys so that the deviation meter reading is  $\pm 4.2$  kHz ( $\pm 0.1$  kHz) (for 25 kHz steps) or  $\pm 2.1$  kHz ( $\pm 0.1$  kHz) (for 12.5 kHz steps) deviation.
- Press the [ENTER] key to lock in the new data.

## CTCSS Deviation

- Set the transceiver to CH 2 (band center).
- Open the “Adjust” window on CE44, then select the “CTCSS Deviation” parameter.
- Press the [ENTER] key to enable programming of this parameter; use the [←] or [→] arrow keys so that the deviation meter reading is  $\pm 0.8$  kHz ( $\pm 0.1$  kHz) (for 25 kHz steps) or  $\pm 0.5$  kHz ( $\pm 0.1$  kHz) (for 12.5 kHz steps) deviation.
- Press the [ENTER] key to lock in the new data.

## DCS Deviation

- Set the transceiver to CH 3 (high band edge).
- Open the “Adjust” window on CE44, then select the “DCS Deviation” parameter.
- Press the [ENTER] key to enable programming of this parameter; use the [←] or [→] arrow keys so that the deviation meter reading is  $\pm 0.8$  kHz ( $\pm 0.1$  kHz) (for 25 kHz steps) or  $\pm 0.4$  kHz ( $\pm 0.1$  kHz) (for 12.5 kHz steps) deviation.
- Press the [ENTER] key to lock in the new data.

## RF Frequency

- Set the transceiver to CH 2 (band center).
- Open the “Adjust” window on CE44, then select the “RF Frequency” parameter.
- Press the [ENTER] key to enable programming of this parameter; use the [←] or [→] arrow keys so that the frequency counter displays the band center frequency ( $\pm 100$  Hz) for the version being aligned.
- Press the [ENTER] key to lock in the new data.

## Sensitivity

- Set the transceiver to CH 3 (high band edge).
- Tune the RF signal generator to the same frequency as the transceiver's, then set the generator output level to 40 dB $\mu$  with  $\pm 3.0$  kHz deviation @ 1 kHz tone modulation.
- Open the “Adjust” window on CE44, then select the “RX Tune” parameter.
- Press the [ENTER] key to enable programming of this parameter. Use the [←] or [→] arrow keys to tune for best sensitivity; ultimately, the radio should be aligned so that the RF signal generator output level is -6 dB $\mu$  EMF (0.25  $\mu$ V) or less for 12 dB SINAD.
- Press the [ENTER] key to lock in the new data.