

## VX-4107/4207 Alignment

### Introduction

The VX-4100/4200 series are carefully aligned at the factory for the specified performance across the frequency range specified for each version. Realignment should therefore not be necessary except in the event of a component failure, or altering version type. All component replacement and service should be performed only by an authorized **Vertex Standard** representative, or the warranty policy may be void.

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 subsequently are placed, 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** reserves 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 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

- RF Signal Generator with calibrated output level at 500 MHz
- Deviation Meter (linear detector)
- In-line Wattmeter with 5 % accuracy at 500 MHz
- 50  $\Omega$  RF Dummy Load with power rating 100 W at 500 MHz
- 4  $\Omega$ /12 W AF Dummy Load (**Attention** : Audio output is BTL output)
- Regulated DC Power Supply (standard 13.6 V DC, 15 A)
- Frequency Counter with 0.2 ppm accuracy at 500 MHz
- Audio Signal Generator (available to output 30 Hz to 5 kHz)
- AC Voltmeter
- DC Voltmeter
- UHF Sampling Coupler
- IBM PC / compatible Computer with Microsoft Windows95 or later operating system
- Vertex Standard** VPL-1 Connection Cable & CE59 Programming software.

## Alignment Preparation & Precautions

A 50  $\Omega$  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.

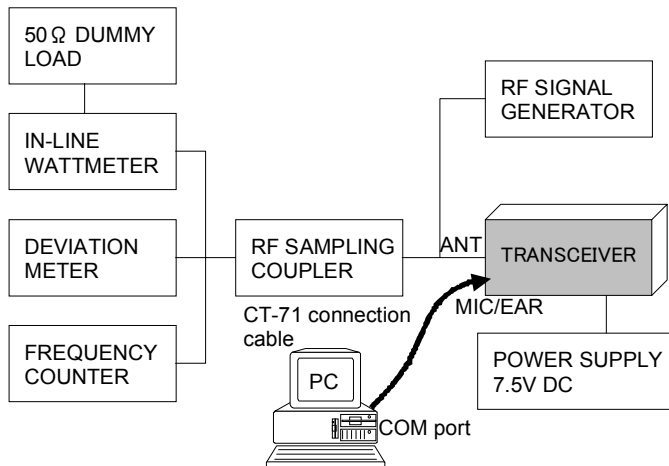
After completing one step, read the following step to determine whether the same test equipment will be required. If not, remove the test equipment (except dummy load and wattmeter, in connected) before proceeding.

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 the alignment procedure are based on  $0dB_{\mu} EMF = 1\mu V$ .

Setup the test equipment as shown for transceiver alignment, apply 13.6V DC power to the transceiver. Refer to the drawings above for Alignment Points.



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 switching range of the equipment it is recommended that the channel data in the transceiver is preset as the chart below.

Channels	Frequency (Simplex)
	UHF-A(VTX)
Band-LOW	400.100MHz
Band-MID	435.100MHz
Band-HIGH	469.900MHz

The alignment mode is accessed by “Alignment mode” command from the computer whilst switching on. And the alignment tool operates it automatically.

During the alignment mode, normal operation is suspended. Use the alignment tool program running on PC.

## The alignment tool outline

### Installation the tool

Install the CE59 (Clone Editor) to your PC.

The re-alignment for VX-4200/4100 series may use the “Alignment” menu of CE59.

#### Action of the switches

When the transceiver is in alignment mode, the action of [PTT], [KEY] is ignored. All of the action is remote controlled by PC.

### Basic sequence

The data displayed in screen of this tool is temporary data, and there is fear that the consistence of the displayed data and the data in the transceiver is failure when you do not keep the sequence which is specified below.

#### Basic sequence

1. Enter the alignment mode
2. Data upload
3. Align data
4. Data download

When finish the alignment one parameter, the tool ask you " Update this data? ". If you select "Yes", the temporary data is updated.

If you select "Yes", the tool downloaded data to the transceiver.

## Menu of the tool

### BASIC Alignment

In the Basic Alignment mode, the aligned data written in the radio will be able to re-align its alignment data. In this mode, there are many items to align with three point (low edge, center and high edge) except "VCO", "RX Tune" and "Mod Balance". The value of each parameter can be changed to desired position by <- / -> arrow key for up/down, direct number input and drag the mouse.

To enter the Basic Alignment Mode, select "Basic Alignment" in the main menu "Radio". It will start to "Upload" the written personalized data from the radio and to "Download" alignment data to the radio. Then pressing the button "OK" will start the Basic Alignment Mode.

Note; when all items are aligned, it is strongly recommended to align according to following order. The detail information is written in the CE59 (Clone Editor).

1. RX VCO Tune Voltage (RX VCO)
2. TX VCO Tune Voltage (TX VCO)
3. PLL Reference Frequency (Frequency)
4. RX Sensitivity (RX Tune)
5. Squelch (SQL)
6. TX Power
7. Modulation Balance <Wide>
8. Modulation Balance <Narrow>
9. Maximum Deviation <Wide>
10. Maximum Deviation <Narrow>
11. Sub-Audio (CTCSS/DCS) Deviation

### **1. RX VCO Tune Voltage (RX VCO)**

This parameter is to align the "Tune Voltage" of RX VCO. This alignment will be done automatically between the radio and PC.

- a. Press the "Start" button, to start the alignment.
- b. It will be showed an aligned value on the PC.
- c. Press the "OK" button on the confirmation window, the auto-alignment for RX VCO will be accomplished.

### **2. TX VCO Tune Voltage (TX VCO)**

This parameter is to align the "Tune Voltage" of TX VCO. This alignment will be done automatically between the radio and PC as same as the "RX VCO".

- a. Press the "Start" button to start the alignment.
- b. It will be showed an aligned value on the PC.
- c. Press the "OK" button on the confirmation window, the auto-alignment for RX VCO will be accomplished.

### 3. PLL Reference Frequency (Frequency)

This parameter is to align the reference frequency for PLL. It must be done the VCO alignment before this alignment is going to start.

- a. Press the “Start” button to start the alignment and the radio then will transmit.
- b. Set the value to get desired frequency on the frequency counter.
- c. Press the “OK” button after the alignment is accomplished.
- d. Press the “OK” button on the confirmation window to save the re-aligned value, the alignment of the PLL Reference Frequency is accomplished.

### 4. RX Sensitivity (RX Tune)

This parameter is to align the RX BPF (Band Pass Filter). It must be done both alignments of the “RX VCO” and “Frequency” before this alignment is going to start.

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

### 5. SQL (SQL)

This parameter is to align the SQL (Squelch). It must be done the “RX VCO”, “Frequency” and “RX Tune” before this alignment is going to start.

#### Noise SQL Tight<Wide> (TI NSQ W)

This parameter is to align the Noise SQL Tight level at Wide (5k/4k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### Noise SQL Threshold <Wide> (TH NSQ W)

This parameter is to align the Noise SQL Threshold level at Wide (5k/4k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### RSSI SQL <Wide> (RSSI SQL W)

This parameter is to align the RSSI SQL Tight level at Wide (5k/4k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### TX SAVE <Wide> (TX Save W)

This parameter is used for only portable radio.

This parameter is to align the RSSI level for TX save function at Wide (5k/4k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **Noise SQL Tight <Narrow> (TI NSQ N)**

This parameter is to align the Noise SQL Tight level at Narrow (2.5k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **Noise SQL Threshold < Narrow > (TH NSQ N)**

This parameter is to align the Noise SQL Threshold level at Narrow (2.5k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **RSSI SQL < Narrow > (RSSI SQL N)**

This parameter is to align the RSSI SQL Tight level at Narrow (2.5k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **TX SAVE <Narrow> (TX Save N)**

This parameter is used for only portable radio.

This parameter is to align the RSSI level for TX save function at Narrow (2.5k).

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator according to the indication, then press “OK”.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

## **6. TX Power**

**High** (High power version: VHF 50 W/UHF 45 W, Mid power version: 25 W)

This parameter is to align TX High power.

- a. Press the “Start” button to start the alignment then the radio will transmit.
- b. Set the value to get desired output power on the Power Meter by changing the Scroll Bar on your PC.
- c. Press the “OK” button to save the alignment data and the alignment is accomplished.

**Low3** (High power version: 25 W, Mid power version: 12.5 W)

This parameter is to align TX Low3 (LH) power.

- a. Press the “Start” button to start the alignment then the radio will transmit.
- b. Set the value to get desired output power with the Power Meter by changing the Scroll Bar on your PC.
- c. Press the “OK” button to save the alignment data and the alignment is accomplished.

This parameter is used to align TX Low3 (LH) power.

**Low2** (High power version: 10 W, Mid power version: 5 W)

This parameter is to align TX Low2 (LM) power.

- a. Press the “Start” button to start the alignment then the radio will transmit.
- b. Set the value to get desired output power with the Power Meter by changing the Scroll Bar on your PC.
- c. Press the “OK” button to save the alignment data and the alignment is accomplished.

**Low1** (High power version: Not Used, Mid power version: 1 W)

This parameter is to align TX Low1 (EL) power.

- a. Press the "Start" button to start the alignment then the radio will transmit.
- b. Set the value to get desired output power with the Power Meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button to save the alignment data and the alignment is accomplished.

### **Modulation Balance**

The radio has original value as backup data that aligned at factory in the ROM area. It is recommended not to re-align as far as possible.

This parameter is to align the balance of the VCO Modulation and Reference Modulation. It must be done the alignment of "RX VCO" before this alignment is going to start.

### **Modulation Balance <Wide> (MOD BAL W)**

- a. Connect the Audio Generator to pin15 of D-Sub and pin1 of AF-IN at back of the radio.
- b. Press "START" button to start the alignment, the radio will transmit at low edge frequency.
- c. Set output of the Audio Generator to 40 Hz / 50 mV rms. Note the value of the deviation meter.
- d. Set output of the Audio Generator to 3 kHz / 50 mV rms. Adjust the Mod Balance to match the noted the value.
- e. Press OK button, then the radio will transmit at band center.
- f. Set output of the Audio Generator to 40 Hz / 50 mV rms. Note the value of the deviation meter.
- g. Set output of the Audio Generator to 3 kHz / 50 mV rms. Adjust the Mod Balance to match the noted the value.
- h. Press OK button, then the radio will transmit at band high edge.
- i. Set output of the Audio Generator to 40 Hz / 50 mV rms. Note the value of the deviation meter.
- j. Set output of the Audio Generator to 3 kHz / 50 mV rms. Adjust the Mod Balance to match the noted the value and press OK button.
- k. Press OK button again, the alignment data will be saved and the alignment is accomplished.

### **Modulation Balance <Narrow> (MOD BAL N)**

The method of the alignment is same as "MOD BAL W".

### **Maximum Deviation <Wide> (MAX DEV W)**

This parameter is to align Maximum Deviation for Wide Channel. It must be done the alignment of "TX VCO" (and Modulation Balance).

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired deviation (Wide: 4.2 kHz, Narrow: 2.1 kHz) on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

### **Maximum Deviation <Narrow> (MAX DEV N)**

This parameter is to align Maximum Deviation for Narrow Channel. It must be done alignment of the "TX VCO".

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired deviation (Wide: 4.2 kHz, Narrow: 2.1 kHz) on the deviation meter by changing the Scroll Bar on your PC.

- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

### **Sub-Audio Deviation**

This parameter is to align Sub-Audio Deviation. It must be done the alignment of "TX VCO" and "MAX DEV".

#### **CTCSS Deviation <Wide>(CTCSS W)**

This parameter is to align Sub-Audio CTCSS Deviation for Wide Channel. It must be done the alignment of "TX VCO" and "MAX DEV".

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired deviation (Wide: 0.6 kHz, Narrow: 0.4 kHz) on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **DCS Deviation <Wide>(DCS W)**

This parameter is to align Sub-Audio DCS Deviation for Wide Channel. It must be done the alignment of "TX VCO" and "MAX DEV".

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired deviation (Wide: 0.6 kHz, Narrow: 0.4 kHz) on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **CTCSS Deviation <Narrow>(CTCSS N)**

This parameter is to align Sub-Audio CTCSS Deviation for Narrow Channel. It must be done the alignment of "TX VCO" and "MAX DEV".

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired deviation (Wide: 0.6 kHz, Narrow: 0.4 kHz) on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

#### **DCS Deviation <Narrow>(DCS N)**

This parameter is to align Sub-Audio DCS Deviation for Narrow Channel. It must be done the alignment of "TX VCO" and "MAX DEV".

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired deviation (Wide: 0.6 kHz, Narrow: 0.4 kHz) on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

### **MIC Gain**

This parameter is to align Microphone Gain in "Manufacture Mode". This alignment needs FRB-4 (Tuning Interface BOX).

- a. Press the "Start" button to start the alignment.
- b. Set the value to get desired Microphone Gain on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.



### **Sequential Tone Deviation**

This parameter is to align the “Sequential Tone Deviation” (for 2-Tone, 5-Tone and/or DTMF sequential tones) in “Manufacture Mode”.

- a. Press the “Start” button to start the alignment.
- b. Set the value to get desired Microphone Gain on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the “OK” button after finish the adjustment, then the data will be saved and the alignment is accomplished.

### **Low Battery Level**

This parameter is to align the “Low Battery Level” voltage for portable radio in “Manufacture Mode”.

- a. Press the “Start” button to start the alignment.
- b. Set the value of DC Power source to 6.5 V.
- c. Press the “OK” button, then the data will be saved and the alignment is accomplished.

### **EEPROM Protect Level**

This parameter is to align the “EEPROM Protect Level” voltage in “Manufacture Mode”.

- a. Press the “Start” button to start the alignment.
- b. Set the value of DC Power source to 5.5 V for portable radio, 8.0 V for mobile radio.
- c. Press the “OK” button, then re-tune the DC power source to 7.5 V for portable radio, 13.6 V for mobile radio.
- d. Press the “OK” button again, the data will be saved and the alignment is accomplished.

### **CHANNEL Fine Alignment**

In the Channel Fine Alignment Mode is to be able to align the several parameter per channel. To enter the “Channel Fine Alignment”, select “CH Fine Alignment” on the menu “Radio” of CE59 main menu.

Enter the “CH Fine Alignment” menu, the channel selection window will appear. Then select the desired channel and press “OK” button.

The each alignment is as same as the Basic Alignment mode.

In the “Channel Fine Alignment” mode, it is able to align the following items.

- RX Sensitivity
- TX Power High
- TX Power Low
- Modulation Balance
- Maximum Deviation
- Sub-Audio Deviation

### **RX Sensitivity**

This parameter is to align the RX BPF (Band Pass Filter) for the channel.

- a. Press the “Start” button to start the alignment.
- b. Set the Signal Generator to get best RSSI level according to the indication, and press OK.
- c. Press the “OK” button again after finish the adjustment, then the data will be saved and the alignment is accomplished.

### **TX Power High**

This parameter is to align the “TX Power High”.

- a. Press the “Start” button to start the alignment then the radio will transmit.

- b. Set the value to get desired output power on the Power Meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button to save the alignment data and the alignment is accomplished.

### **TX Power Low**

This parameter is to align the "TX Power Low".

- a. Press the "Start" button to start the alignment then the radio will transmit.
- b. Set the value to get desired output power on the Power Meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button to save the alignment data and the alignment is accomplished.

### **Modulation Balance**

- a. Connect the Audio Generator to pin15 of D-Sub and pin1 of AF-IN at back of the radio.
- b. Press "START" button to start the alignment, the radio will transmit at low edge frequency.
- c. Set output of the Audio Generator to 40 Hz / 50 mV rms. Note the value of the deviation meter.
- d. Set output of the Audio Generator to 3 kHz / 50 mV rms. Adjust the Mod Balance to match the noted the value.
- e. Press OK button, then the radio will transmit at band center.
- f. Set output of the Audio Generator to 40 Hz / 50 mV rms. Note the value of the deviation meter.
- g. Set output of the Audio Generator to 3 kHz / 50 mV rms. Adjust the Mod Balance to match the noted the value.
- h. Press OK button, then the radio will transmit at band high edge.
- i. Set output of the Audio Generator to 40 Hz / 50 mV rms. Note the value of the deviation meter.
- j. Set output of the Audio Generator to 3 kHz / 50 mV rms. Adjust the Mod Balance to match the noted the value and press OK button.
- k. Press OK button again, the alignment data will be saved and the alignment is accomplished.

### **Maximum Deviation**

This parameter is to align Maximum Deviation on the channel in Manufacture mode.

- a. Press the "Start" button to start the alignment and the radio will transmit.
- b. Set the value to get desired deviation on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.

### **Sub-Audio Deviation**

This parameter is to align Sub-Audio CTCSS or DCS Deviation of the channel.

- a. Press the "Start" button to start the alignment and the radio will transmit.
- b. Set the value to get desired deviation on the deviation meter by changing the Scroll Bar on your PC.
- c. Press the "OK" button after finish the adjustment, then the data will be saved and the alignment is accomplished.