TYPE OF EXHIBIT:	TUNE-UP PROCEDURE
FCC PART:	2.1033 (c)(9)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	PBS-446D
TYPE OF UNIT:	UHF-FM Base Transceiver
FCC ID:	AIERIT16-446
DATE:	December 9, 2002

The tune-up procedure included in this exhibit is an excerpt of the Maintenance and Operating Manual for RITRON Model Patriot PBS-446D UHF-FM Base Transceiver. The complete Maintenance and Operating Manual is included with this application for Certification as a separate exhibit.

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

WARNING!

An authorized RF service technician must perform test and alignment of the PBS-446D. Do not attempt service of the PBS-446D if not completely familiar with the operation of frequency synthesized radio operation. The PBS-446D can operate in both Narrow Band (2.5 KHz deviation) and Wide Band (5 KHz deviation) systems.

RECOMMENDED TEST EQUIPMENT

1) 0 to +15 VDC, 2A current-limited power supply
2) RF Communications Test Set (to 470 MHz) with:
   - FM Deviation Meter
   - RF Wattmeter
   - Frequency Counter (to 470 MHz)
   - SINAD Measuring Device
3) Oscilloscope (to 20 MHz)
4) VTVM or DMM
5) RITRON PC Programming Kit

RADIO PREPARATION

1) Connect the RPS-1A wall mounted power supply to the PBS-446D.
2) Connect the serial programming cable from the PC computer (with the RITRON PC programming kit software installed) to the 3.5mm audio accessory jack.
3) Remove the PBS-446D antenna and connect the FM communications test set to the BNC antenna connector.
4) Turn on the radio to place it in operating mode.
5) From the PC Programmer on-screen menu, select “Tune Radio” to display the Alignment screen.
6) Set the RF Communications Test set to the Alignment Frequency indicated on the Alignment screen.
7) Press the appropriate “Select” button on the Alignment screen to make the following adjustments:

SELECT	Alignment
Frequency	Transmit frequency
Mod Bal	Modulation balance
Tone	QC/DQC tone encode deviation wide and narrow band
Voice	Voice deviation with no tone wide and narrow band
	Voice deviation with tone wide and narrow band

8) After you have completed alignment of the PBS-446D, turn the radio off. This will remove the test frequencies and return to operation on the customer’s programmed frequencies.

REFERENCE FREQUENCY

1) Make sure the unit has been switched on and is at room temperature (approximately +25° C)
2) Select “Frequency” from the PC Programmer “Alignment” screen.
3) Set the RF communications test set to the Alignment Frequency on the Alignment screen.
4) Press the “Tune” button on the Alignment screen to activate the transmitter.
5) Transmitter frequency error should be less than +/- 500 Hz.
6) If frequency adjustment is required, press the left arrow on the tuning bar to lower the frequency or the right arrow to raise the frequency.
7) Press the “Save” button to store the new alignment setting or “Cancel” to leave setting unchanged.

MODULATION BALANCE

Transmitter modulation balance has been set at the factory and should not require adjustment.

1) Select “Mod Bal” from the PC Programmer “Alignment” screen.
2) Set the RF communications test set to the Alignment Frequency on the Alignment screen.
3) Press the “Tune” button on the Alignment screen to activate the transmitter.
4) Check the de-modulated waveform for a 20 Hz square wave.
5) If adjustment of the modulation balance is required, press the left arrow on the tuning bar to flatten the top of the waveform or the right arrow to reduce overshoot.
6) Press the “Save” button to store the new alignment setting or “Cancel” to leave setting unchanged.

TRANSMITTER TONE DEVIATION

Transmitter tone deviation has been set at the factory and should not require adjustment.

1) Select “Tone” from the PC Programmer “Alignment” screen.
2) Set the RF communications test set to the transmit frequency on the screen.
3) Select either “Wide Band” or “Narrow Band” by pressing the desired option button.
4) Press the “Tune” button on the Alignment screen to activate the transmitter.
5) If adjustment of the tone deviation is required, press the left arrow on the tuning bar to lower deviation or the right arrow to raise deviation.
6) Press the “Save” button to store the new alignment setting or “Cancel” to leave setting unchanged.

TRANSMITTER VOICE DEVIATION

Transmitter voice deviation has been set at the factory and should not require adjustment.

1) Select “Voice” from the PC Programmer “Alignment” screen.
2) Set the RF communications test set to the transmit frequency on the screen.
3) Select “Voice Only - Wide Band“, “Voice Only - Narrow Band”, “Voice & Tone – Wide Band”, or “Voice & Tone – Narrow Band” by pressing the desired option button.
4) Press the “Tune” button on the Alignment screen to activate the transmitter.
5) If adjustment of the voice deviation is required, press the left arrow on the tuning bar to lower deviation or the right arrow to raise deviation.
6) Press the “Save” button to store the new alignment setting or “Cancel” to leave setting unchanged.

RECEIVER SENSITIVITY

The PBS-446D receiver is factory tuned for a frequency range of 450 - 470 MHz.

1) Program the radio to a receive frequency in the middle of the desired band.
2) Set the RF communications test set generator to a frequency exactly 87.3 MHz below the programmed receive frequency at a RF level of approximately –40 dB. Modulate the RF signal with a 1 kHz tone at 3 kHz deviation for wide band, 1.5 kHz deviation for low band.
3) Disconnect the programming cable from the audio accessory jack and connect an 8-Ohm speaker.
4) Adjust L101 for the minimum received signal at this image frequency.
5) Set the RF Communications Test Set’s generator to the programmed receive frequency at a RF level of –120 dB. Modulate the RF signal with a 1 kHz tone at 3 kHz deviation for wide band, 1.5 kHz deviation for low band.
6) Adjust L103 and L104 for the best receiver SINAD as measured across the 8-Ohm speaker.
7) Check receiver sensitivity at the lowest and highest operating frequencies and make slight adjustment to L103 and L104 to balance between the two, if necessary.

RECEIVER NOISE SQUELCH

The noise squelch sensitivity is set at the factory for a 12dB SINAD signal at a “Squelch Tightener” number of 0. Using the PC Programmer, squelch sensitivity can be adjusted on a per channel basis by adjusting the “Squelch Tightener” number to between –2 and 5. The higher number will require a stronger received signal to open squelch.

1) Select “Channel” from the PC Programmer “Edit” menu on the main screen.
2) Select the channel to be set and press “Edit” button.
3) Set the RF communications test set to the transmit frequency on the screen.
4) Enter a Squelch Tightener number between –2 and 5.
5) Press the “OK” button on the Channel Edit screen to return to the Channel List screen.
6) Select any other channels to be set.
7) Press the “OK” button on the Channel List screen to return to the Main screen.
8) Select “Program Radio” from the PC Programmer “Radio” menu to save all setting changes.

SYNTHESIZER

The synthesizer is preset at the factory for operation between 450 and 470 MHz. There is no manual adjustment to center the control voltage, with all adjustment performed by the factory selection of fixed capacitor C413. Do not attempt to adjust the synthesizer control unless a key component in the synthesizer has been replaced. Key components do not include the Y302 reference frequency TCVCXO or U401 synthesizer IC. Synthesizer alignment errors cause poor operation at temperature extremes.

Should adjustment of the VCO control voltage be necessary, the radio must first be disassembled and powered up at 13 VDC. The following procedure defines testing of the VCO control voltage:

1) Select the channel that has the lowest receive frequency.

2) Connect a VTVM, DVM or oscilloscope to Test Point 1 and measure the VCO control voltage. This voltage should be no less than 0.5 VDC.

3) Select the channel that has the highest receive frequency and measure Test Point 1. The control voltage should be no higher than 4.5 VDC.

4) a) If adjustment of the VCO control voltage is required, remove the synthesizer shield top.

   b) Replace C413 with a capacitor value that allows VCO control voltages between 0.5 and 4.5 VDC for the operating frequencies desired. Decreasing the value of C413 will raise the operating frequency of the VCO while increasing the value will lower the VCO frequency.

   c) Replace the top of the synthesizer shield.