**TYPE OF EXHIBIT**: TUNE-UP PROCEDURE

**FCC PART**: 2.983 (d) (9)

**MANUFACTURER**: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

**MODEL**: DTX-454

**TYPE OF UNIT**: UHF-FM Transceiver

**FCC ID:** AIERIT11-450

**DATE:** February 2, 1999

ALL ADJUSTMENTS REQUIRED FOR ALIGNMENT ARE EFFECTED ELECTRONICALLY THROUGH COMPUTER INTERFACE USING RPT-PCPK SOFTWARE. THE DTX-154/454 COVER DOES NOT HAVE TO BE REMOVED FROM THE UNIT FOR ALIGNMENT.

RECOMMENDED EQUIPMENT

1. Power Supply-0 to 15 volts, 3 ampere current capability.
2. FM Service Monitor (500 MHz RF capability).
3. Oscilloscope (100 kHz min.)
4. FM Deviation Meter.
5. RF Wattmeter, 10 watts full scale.
6. Frequency Counter (500 MHz min.)
7. SINAD measuring device.
8. VTVM or DMM.
9. 30 dB RF Power Attenuator.
10. Audio Generator, 300 to 300 Hz, 0 to 1V RMS output.
11. RITRON model RTX-SRVBD adapter
12. RSM-3X
13. PC computer and RITRON PC programmer kit.

Note: The FM Service Monitor may contain include many of the other instruments required.

RADIO PREPARATION

Connect the programming adapter to pin 9 of the radio's DB-15 connector. Install the programming software and open the program. Select the DTX-154/454 radio from the radio menu. If the unit has never been programmed before, the settings should be at their default settings as shipped. If any changes have been made, however, for alignment, the settings should be placed at the default value as shown below:

| Function | Value |
|---|---|
| TX Frequency Trim | 0 |
| RX Frequency Trim | 0 |
| Modulation Balance | 0 |
| TX Deviation ` | 20 |
| AUX IN Audio Gain | 20 |
| AUX OUT Audio Gain | 20 |
| AUDIO OUT Gain | 20 |
| TX Output Power | 12 |
| Squelch Lower Limit | 40 |
| Squelch Upper Limit | 45 |
| TX Timeout Timer | 60 |
| Clipper Filter Enable | On |
| RX De-emphasis Enable | Off |
| Audio PA RX Enable | On |
| RX AC/DC Coupled | AC |
| TX Pre-emphasis Enable | Off |
| AUDIO OUT Squelch Enable | On |
| AUX OUT Squelch Enable | On |
| AUDIO MON Enable | On |
| AUX OUT MON Enable | On |
| Busy Channel Lockout Enable | On |
| DCD Polarity | Normal |
| PTT RTS Polarity | Normal |

MON Polarity Normal

SETUP

Using the VTVM (or DMM), set the Power Supply to the correct supply voltage. Connect the positive lead of the supply to pin 6 of the radio's DB-15 connector. Connect the negative lead to pin 15. Connect the FM Service Monitor to the BNC RF connector on the unit.

Program the desired operating frequencies into the unit for both transmit and receive.

TRANSMITTER

Output Power

In the programming program, advance to the TX Output Power section. The current channel will be highlighted. Key the unit via the program and adjust the TX POWER value until the correct power is noted. Repeat for all channels. The unit must be un-keyed before a channel can be changed.

Frequency

Note: The unit must be at an ambient temperature of 22 +/- 1 C (71.6 +/- 1.8 F) for proper setting of frequency.

Move to the TX Frequency Trim section of the programming software. Choose a channel whose frequency is near the middle of the group of programmed channels. Set the Service Monitor to display transmit frequency or connect a Frequency Counter to the unit through a Power Attenuator. Key the unit via the program and adjust the value for the correct frequency. If the unit has been programmed correctly, this value should be satisfactory for all channels and can be made common to all channels in the program. If desired, however, the frequency for each channel may be set individually.

Deviation and Balance

An audio generator set to 500 Hz should be connected to pin 7 (AUX IN) of the DB-15 connector. The output level should be set for 500 mv RMS. The RF output of the unit should be connected to the FM Service Monitor. The Service should be set up to display the demodulated output signal on an oscilloscope. Minimal filtering of the demodulated signal, especially on the low frequency end, should be used. De-emphasis should not be used.

Move to the Modulation Balance section of the program. Select a channel near the middle of the programmed frequency range. Key the unit and confirm that a sinewave or clipped sinewave is visible on the oscilloscope. Increase the audio generator level until clipping is clearly visible. Adjust the value until the clipped portion is as flat as possible. There may be some initial overshoot at the clipping point, but the region after should be flat. This adjustment must be repeated for all channels if the frequencies differ by 2 MHz or more.

Move to the TX Deviation section of the program. Set the FM Service Monitor to measure transmitter modulation deviation or connect an FM Deviation meter to the unit through the RF Power Attenuator. With the audio generator still connected and set at the same level as above, adjust the frequency of the generator until the greatest deviation is noted. Set the deviation value to product the correct maximum deviation, i.e. 2.5 kHz for 12.5 kHz operation and 5 kHz for 25 kHz operation. This adjustment must be repeated for all channels if the frequencies differ by 2 MHz or more.

Other Functions

The other features/functions of the unit should be set via the programming software for transmit operation as desired or returned to the previous settings.

RECEIVER

The AUDIO OUT pin (pin 12 on the DB-15 connector) on the unit should be connected an oscilloscope. Connect the RX MON pin (pin 11 on the DB-15 connector) to ground. Noise should be visible on the oscilloscope.

Front-End

The front-end filters have been tuned at the factory for optimum performance across the entire frequency band of operation. Unless the factory settings have been altered, no adjustment is necessary or advisable. Aligning the front-end requires programming the unit for receive frequencies at the center and each end of the band and noting the sensitivity at these three frequencies. With a SINAD meter attached to the AUDIO OUT pin, the sensitivity should be at or below specification at all receive frequencies. If it is not, the slugs in L101 through L106 should be made flush with the top of their cans and then turned clockwise 1 turn so that the slug is slightly recessed into the can.

The sensitivity should be checked and compared at the center and band edges. If the sensitivity is significantly worse (3 dB or more change required at the RF generator), at one frequency, each slug should be varied in position slightly and the one(s) having the most effect should be adjusted slightly for improved sensitivity. The other channels should be checked to insure that sensitivity has not degraded. This process may need to be repeated a number of times at different channels to insure satisfactory sensitivity across the band. Typically, the sensitivity is slightly better (about 1 dB on the RF generator) at the center channel.

Frequency

Because the transmitter and receiver use the same reference oscillator, TX Frequency Trim values can be used for receive also. If a common value was used for transmit, this value is also already stored as the correct value for receive. If different values are used per channel on transmit, the default value or possibly, the average of the values used in transmit, should be used. For some critical applications it may be possible to optimize the receive frequency trim values by connecting a distortion meter (a SINAD meter may be used if the 1 kHz tone on the generator is adjusted in frequency for highest SINAD) to the AUX OUT pin and adjusting for lowest distortion on a noise quieted RF signal at the correct frequency.

Squelch Setting

The squelch is set by moving to the Squelch Lower Limit section of the program and setting the RF generator output level to the point below which the receiver will be muted (squelched). This point may be determined either by a SINAD reading or by RF level. The choice should be determined by how resistors R124 and R125 are set (the default setting is for SINAD based squelch). When the proper level is reached, the proper command is set in the program and the RSSI value from the RF board at that instant is stored as the lower limit squelch setting.

The upper squelch limit is set by moving to the Squelch Upper Limit section of the program. The RF generator level should be set to the point above which the receiver will always be unmuted. Typically, this setting is a few dB's higher in RF level that the lower squelch limit. The difference between the two values is the squelch hysteresis and prevents squelch chattering.

Other Functions

The other features/functions of the unit should be set via the programming software for receive operation as desired or returned to the previous settings.