Tuning and Adjustment of the French TR-PP-11B

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1. Introduction

This small, transistorised, ‘handie-talkie’, developed in the sixties, is now available from various surplus dealers. In addition to production for the French military, the set was ‘badged’ for other nations, for example, as the AVP-1 for Portugal. It was also manufactured under licence in Italy as the RV-2/11.

Fig.1 TR-PP-11B with auxiliary handset

The set history and circuitry was described in VMARS Newsletter 24. It is distinctive and easy to use since it works happily from a 12 volt gel cell or a NiCd battery stack and covers amateur frequencies around 50 MHz. In military service it was adjusted and trouble shot using dedicated test set MR-TX-13A. There is no known military manual covering its alignment with conventional test equipment. This note explains how it can be tuned and adjusted with the minimum of test equipment.

2.Technical Detail

Frequency coverage:	47 to 56.950 MHz
Channels:	6
Channel spacing:	50 kHz.
FM modulation:	10 kHz
Receiver IF frequency:	11.5 MHz
Receiver sensitivity:	Less than 1µV for 20 dB (S+N)/N
Receiver selectivity:	± 18 kHz 6 db, ± 50 kHz 70 db
Receiver discriminator:	± 3 kHz, 50 mV/kHz
Receiver audio output:	5 mW into 2 kΩ
RF Power output:	350 to 850 mW. Varies with battery voltage and set tolerances.
Frequency stability:	± 3.5 kHz -40 to +55^{0}C
Power supply nominal:	15 volts DC (16 to 10 volts over a normal battery discharge).
Current drain:	Rx 25 mA, Tx 180 to 220 mA, varies with battery voltage and set tolerances.
Range:	3 to 8 km depending on terrain.

Crystal type: CR-81/U, third overtone (series resistance less than 40Ω). Crystal frequency is Channel Frequency minus 11.5 MHz IF frequency.

The set is constructed from 14 plug connected assemblies or modules and most transistors are in plug-in bases.

Note: Internal screws that may be loosened during servicing, when required, are painted GREEN. **SCREWS THAT MUST NOT BE SLACKENED OR ADJUSTED ARE PAINTED RED.** This does not include red locking compound on coil core studs.

3. TR-PP-11B Alignment

3.1 General

The TR-PP-11B alignment is unusual. The radio employs a 5 gang variable capacitor, the tuned circuits of which must track and tune over the waveband of the set. However, the receiver local oscillator, and the transmitter frequencies derived from it, are generated by fixed channel crystals. Consequently, each position on the channel selector switch has a preset screw piston to adjust the variable capacitor shaft to match the selected crystal channel frequency.

A lever from the capacitor shaft also permeability tunes the whip aerial loading coil.

3.2 Stage 1 Alignment

The MR-TX-13A test set included 3 test crystals for channels 47.1, 51 and 56.9 MHz. These were fitted to 3 of the crystal switch positions in the TR-PP-11B. The set was then aligned at the 3 test crystal frequencies. However, just as a simple receiver must be aligned to its mechanical tuning scale there is need to specify the mechanical position of the 5 gang capacitor at each of the test frequencies.

The datum position for the capacitor is with its vanes approaching full mesh such that the 1.5 mm holes in its fixed and moving vanes are in alignment. The frequency corresponding to this is 47 MHz. The capacitor position for 56.9 MHz is 14 turns of the crystal switch piston from its 47 MHz or datum position. These two piston positions defined the two mechanical ends of the ‘tuning scale’.

The channel switch pistons were adjusted to the mechanical positions above. Switching between Receive and Transmit, as appropriate, the 5 preset coils and 5 capacitor trimmers on the gang capacitor chassis were then aligned. Capacitor trimmers were aligned at 56.9 MHz and the coils at 47.1 MHz until the 5 tuned circuits tracked accurately over the set's waveband. Stage 1 produced an aligned radio the RF circuits of which could be tuned by the channel switch pistons to match the operational crystals.

3.3 Stage 2 Alignment

Finally the 6 operational crystals were fitted to the radio. It was then set up for these crystal frequencies using only the crystal switch pistons. In theory if a radio required only a change of channel crystals the Stage 2 Alignment by itself was all that was required.

3.4 Practical Considerations

The enthusiast is unlikely to want to buy test crystals that will not be used operationally. Consequently, the alignment described in this note is based on using the operational crystals directly. A problem with this approach is that apart from the specified end of band piston positions there are no published data on piston position at intermediate frequencies. The average relationship is 1.4 turns of the piston per MHz but this is not constant. It is less than 1.4 at the low frequency end of the band and it is greater than 1.4 turns per MHz at the high frequency end of the band.

Normally, 6 m frequencies only will be of interest to the amateur, i.e. 50.01 to 51.99 MHz with 20 kHz channel spacing. However, if there is need the enthusiast can use the data in this note to construct a full waveband tuning procedure.

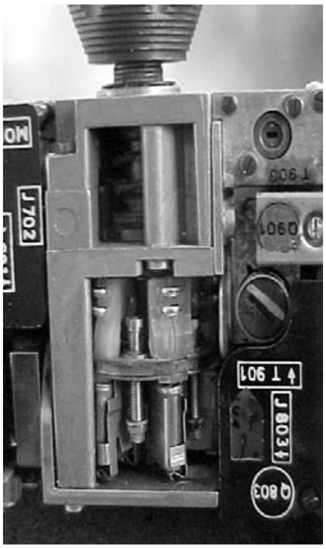

Fig.2 Crystal turret showing crystals at the bottom in their retaining clips plus a screwed piston

4. Test Equipment Required

- A DC power supply of 15 volts, 500 mA with adjustable current limit.
- A VHF FM signal generator covering 10 to 100 MHz, minimum steps 100 Hz, FM modulation adjustable from 2 to 10 kHz in steps of 1 kHz.
- A 20 MHz scope or better with a 1 MΩ probe.
- A frequency counter up to 100 MHz.
- A digital voltmeter (DVM).
- A home made dummy load for RF power output measurement.
- A signal strength meter.

5.Condition of Set

If suitable crystals are not supplied with the radio they should be procured for the required frequencies to the specification in Section 2 of this note.

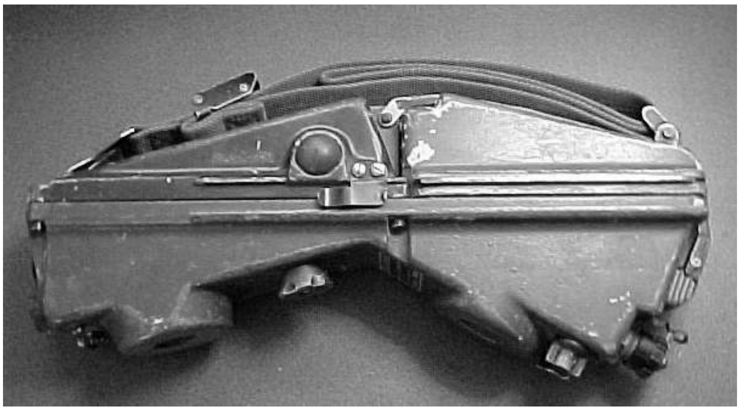

Fig. 3 Side view of set

With crystals available two further conditions may arise:

5.1 The set is dead.

5.2 The set is working but it is uncertain if it is properly tuned.

6. Condition 1 (The set is dead)

6.1 Connect the 15 volts power supply to the battery terminals with its current limit set to about 250 mA (to reduce the risk of damage to the radio).

6.2 Select the lowest frequency.

6.3 Switch ON the set by turning its 'EXT – O – INT' switch to INT and monitor the current. It should be around 20 to 30 mA in RECEIVE. Turning the volume control should increase and decrease the hissing noise in the set earpiece. If the set produces no noise, check that the earpiece is not defective (open circuit).

6.4 If there is a high current consumption switch-off immediately (set the switch to 'O') and carry out the test sequence below.

6.5 Open the set back cover (4 Allen screws).

6.6 Remove the channel selector knob.

6.7 Unscrew the channel switch selector nut.

6.8 Turn the set upside down and un-screw the set mounting screw near the aerial terminal.

6.9 Gently pull the set out of its case.

6.10 Disconnect the set and start to remove module after module to localise the short (either with the ohmmeter or by reconnecting the module and powering up the radio).

6.11 Rectify any defects discovered.

7. Condition 2 (The set alignment is uncertain)

When the final operating crystals are fitted, check the band tuning as below:

7.1 Remove the set from its case as described in 6.1 to 6.5 above and reconnect the set.

7.2 Select the lowest frequency channel. Align the 1.5 mm holes in the fixed and moving vanes of the 5 gang capacitor. Where ‘x’ is the channel frequency in MHz, open the capacitor vanes by screwing the piston on the channel selector by (x-47) x 1.4 turns. e.g. if x=51 MHz the piston would be screwed in by (51-47)x1.4 = 5.6 turns. Use a small box spanner as found in Chinese jeweller screwdrivers sets.

7.3 Temporarily solder a piece of coaxial cable to the 50Ω spring contact for the mini BNC connector (Caution: Not the whip aerial spring terminal). Connect this lead to the VHF signal generator.

7.4 Set the signal generator frequency to the channel frequency, its output to 10 μV, and its modulation to 5 kHz.

7.5 Check that the sensitivity is better than 1 μV by reducing the signal generator output level and also reduce the modulation frequency while listening to the audio output for minimum noise.

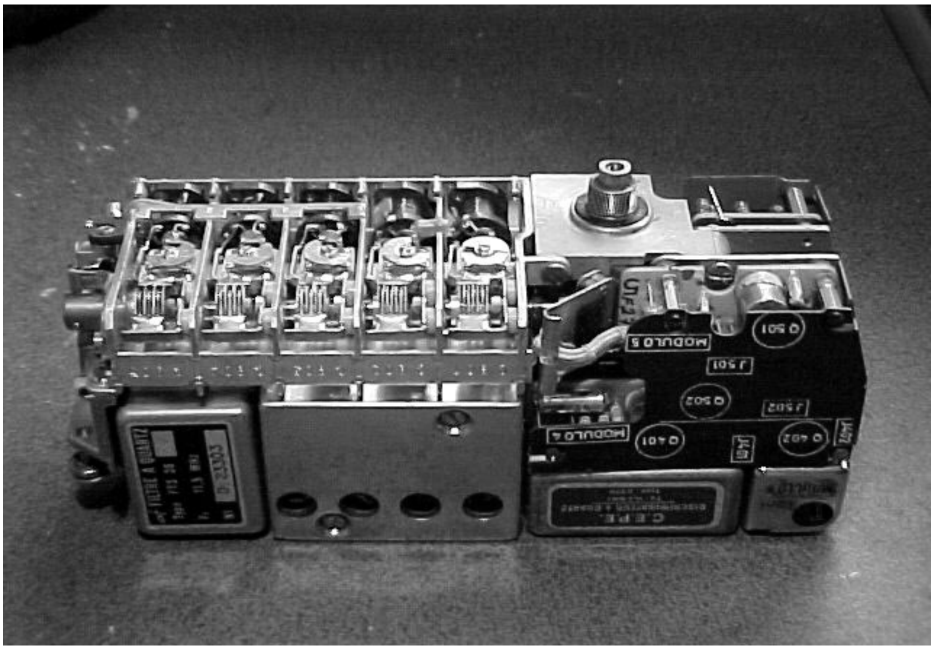

Fig.4 Set chassis removed from case

7.6 If the sensitivity is good, select the highest frequency channel. Align its plunger as described in 7.3 and repeat tests 7.5 and 7.6 for that frequency.

7.7 If the result is good then the band tracking is satisfactory; if not the coils and trimmers should be adjusted as described below.

7.8 Select the lowest frequency channel and fine tune to maximum using coils T-903 and T-904 with an insulated trimming tool.

7.9 Re-check the sensitivity on the highest frequency channel. If necessary, tune transformer C-901 and C-902 for maximum. Then re-check the highest frequency channel.

7.10 When alignment and tracking between the lowest and highest frequency channels is satisfactory proceed to transmitter alignment.

8. Transmitter

Before testing the transmitter construct the small dummy load/detector described below. Use thin shielded cable for the DC output voltage to the DVM.

There are two methods of using the dummy load :

Installed outside the case (in case of problem)

or

Installed in the case (if operating correctly)

Connect or clip the load input to the sub miniature 50 Ω BNC type coaxial connector or to its connection spring if the radio is outside its case.

8.1. Dummy Load Construction

Use a solid carbon resistor of 51 ohms 0.5 watt. The resistor must be close to this value to maintain calibration given in table 1 below. These calibration data are typical but will change with component tolerance. The coupling capacitor is silver mica with a value of 50 pF, 1% tolerance. Select one close to this value.

Use perforated board to assemble the dummy load. Employ a short link to attach the dummy load to the radio module (not more than 2 cm).

Connect or solder the detector to the radio (ground connection to the shield of module 13 and live connection to the spring contact of the 50 ohm connector) or to the small coaxial connector itself if the dummy load is outside the case.

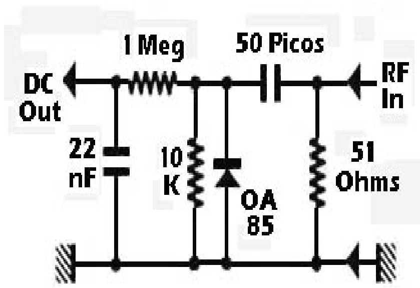

Fig.5 Dummy Load Schematic

W	1.00	0.64	0.49	0.36	0.25	0.12	0.06
V	5.08	4.00	3.27	2.70	2.00	1.27	0.75

W = RF Input Watts V = DC Output Volts

Table 1: Dummy Load Performance. DC Voltage versus transmitter RF power.

8.2. Checking the RF Power Output

Do not re-adjust the turret plungers.

8.2.1 Select the lowest frequency channel.

8.2.2 With the dummy load installed and connected to the DVM, press the PTT and read the voltage.

8.2.3 Fine tune the output by adjusting coils T-907, T-906 and T-905 for maximum output. It should be 350 to 850 mW.

8.2.4 Select the highest frequency channel.

8.2.5 Press the PTT and adjust capacitor trimmers C-903, C-904 and C-905 for maximum output.

8.3 Checking the Radiated Signal

With the tape aerial installed on the set, use a signal strength meter and, holding the set firmly, push the PTT and adjust the L-904 aerial loading coil for maximum radiation.

8.4 DC Current Drain

In TRANSMIT the current should be 180 to 230 mA depending on the supply voltage, the tuning and the condition of the set.

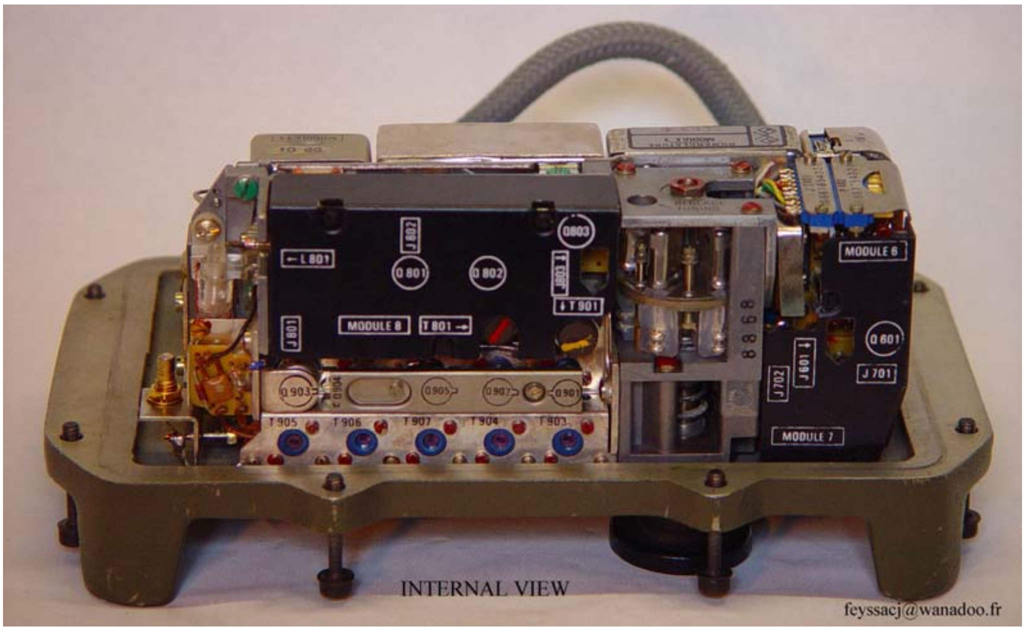

Fig.6 The TR-VP-11 with case removed

9. Tuning the Intermediate Channels

For each of the intermediate channels set the channel switch plungers as described in 7, above. With the dummy load installed and connected to the DMM, press the PTT and read the voltage. Adjust the turret plunger (hole marked 'reglage'/tuning) for maximum RF output voltage.

10 In Case of Problems

10.1 Check the discriminator.

The discriminator is a factory sealed crystal unit. This test checks that it is operating correctly. If found faulty it will need replacing.

10.1.1 Inject an 11.5 MHz signal at 100 mV, without modulation, through a 100 pF capacitor to the stator of C-901 (under transformer T-903).

10.1.2 With a micro test clip, attach the positive lead of a DVM to pin 7 of J-1101 (the 10 pin connector to the potentiometers and power switch), the negative lead to ground.

10.1.3 Check the zero of the discriminator response and note it. This is not always zero volts DC.

10.1.4 Check at +10 kHz, note the value.

10.1.5 Check at -10 kHz, note the value.

10.1.6 Verify that the spread is similar on both sides of the characteristic.

10.2 Audio Testing

Use the same connections as above, but with pin 7 connected to the 'scope. Modulate the signal generator at 1 kHz FM mode with an index of modulation of 1 kHz and increase this to 10 kHz measuring the peak-to-peak audio output. The results should be as given in table 2.

kHz	1	2	4	5	7	9	10
mV	40	60	120	150	210	255	280

kHz = SG modulation mV= pk-pk audio output

Table 2. Audio output at different frequencies

Above 5 kHz a small amount of distortion will be visible.

10.3 Checking the Audio

Connect the 'scope probe to the earphone and verify the quality of the signal.

10.4 Checking the 11.5 MHz Oscillator

10.4.1 On module 2, disconnect jumper P-201. Removing jumper P-201 breaks the automatic frequency control (AFC) loop holding the LC oscillator at 11.5 MHz. This allows the free running frequency of the LC oscillator to be set accurately to 11.5 MHz so ensuring it will be reliably within the capture range of the AFC loop.

10.4.2 Connect the frequency meter to J-803 (red pin) on module 8 (near the crystals)

10.4.3 Push the PTT switch and read the frequency; if frequency is within 1 kHz of 11.5 MHz do not touch anything, if not re-adjust L-801 (aerial side). Loosen the small locking nut before adjusting the core. Re-tighten after adjustment.

10.4.4 Reconnect jumper P-201

Postscript

The TR-PP-11 chassis is also used in the TR-VP-11 vehicle set. Consequently, this alignment note is also valid for the TR-VP-11. For vehicle application the set box also contains a 1 watt AF amplifier with squelch and a regulated power with spike filtering.

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