

## The French TR-PP-11 Jacques Feyssac and Murray McCabe

### Part 2 - Where to find them and technical details.

The first part of this article described how these sets fitted into the general development of VHF/FM military field radios. We continue with the technical details.

#### TR-PP-11s on the Surplus Market

In February 2002 the Italian website [www.radiosurplus.it](http://www.radiosurplus.it) advertised TR-PP-11s for 20 euro, about £12 or \$18.

It is unusual for the French to release radios of the age of the TR-PP-11. Normally French army radios that reach the end of their military service go from the Army to the Gendarmerie and then to war emergency stores. French PRC-10 valve equipment was only released in recent years and there is nearly 15 years between the design dates of the PRC-10 and the TR-PP-11. However, times and practices change.

E-mail exchanges with the dealer, plus translation help from the local Italian café owner, established that the sets offered were untested and thought to be complete but not guaranteed to be so. Because of the weight breaks in European postal rates the cost of postage would be 22 euro whether one or two sets were bought.



The French 'Banana'

set. As outlined above the set was of historical and technical interest so the decision was taken to gamble. Two sets were ordered, the dealer advised despatch by e-mail and the radio parcel arrived 10 days later.

Both the pessimist and the optimist proved to be part correct. One radio was missing most of its modules but had a set of crystals. The second radio was nearly complete but its earpiece was open circuit. In the event it proved possible to build one good radio from the two but there is no

guarantee that a repeat order would have the same fortunate outcome.

Inspection of the sets explained their presence on the surplus market. They were normal TR-PP-11-Bs, manufactured about 1971 but badged by Thomson-CSF for the Portuguese Army as 'Emissor Receptor AVP-1". Both sets had been classified as defective and committed to workshops in the early 1990s. In other words the two sets purchased had not been retired from service in good order but had been hospital cases.

#### TR-PP-11 Description

Inspection of the radios and their circuits plus data from Refs.1 and 2 produced the following appreciation of the set.

The TR-PP-11 is basically the shape of an overgrown telephone handset, more square lined and thinner than the PRC-6. Two TR-PP-11s laid one on top of the other are about the same size and volume as the PRC-6. The TR-PP-11 is 322 x 67 x 115 mm and weighs 2 kgs including its battery.

The antenna is a 0.63 m long laminated steel tape whip that can be wrapped round the set for stowage. The antennae of both sets bought had seen better days but were recoverable. There is a subminiature BNC connector for 50 ohm external antenna equipment. A 3 way rotary switch (centre OFF) provides ON/OFF switching plus the option of operation and RT switching from an external handset or headset. These audio ancillaries can be connected via a 6 pin connector and are designed specifically for the TR-PP-11. As a throw back to the C/PRC-26, when the TR-PP-11 is switched for use with its external handset its earpiece remains live so that the set operator can monitor handset traffic. The set has a volume control but no SQUELCH.

A folded, adjustable strap at the rear of the set allows it to be carried on the shoulder when not hand held. In this mode it can be classed a body portaged set rather than a handheld.

The case is constructed from 3 rugged alloy castings. The set enclosure is sealed from the battery section of the case but the case is not desiccated. The battery cover is toggle clamped to the set case and gasket sealed. Separate bleed screws are provided for the set case and the battery compartment. The reason for the screws is unclear but it could be to prevent undesirable set-to-atmosphere differential pressures during unpressurised air transport. With the bleed screws tightened home the set will resist water immersion. External components that can be detached (battery box cover, whip and connector covers) are linked to the main set with nylon cord to prevent loss in the field.

The TR-PP-11 has a small, robust crystal turret switch. To prevent accidental change of channel the switch knob has to be lifted before it can be turned. The knob has a pointer at CHANNEL 1 to allow its setting to be determined by touch in the dark. Each switch position has a screw adjustable mechanical plunger that acts on a cam to adjust a miniature 5 gang, silver plated, variable tuning

condenser. The plungers allow the RF circuits of each channel to be pre-tuned to match the crystal in use. This permits any channel position to be tuned to any frequency in the set's 47 to 57 MHz range and so designs out the TR-PP-8-A restrictions in this area.

With its miniature tuning condenser and tuning mechanism plus the multitude of small screws holding modules and assemblies together the TR-PP-11 is something of a clockmaker's set. Some of the set modules are easily dismantled by removing securing screws and unplugging the module. Other modules require careful de-soldering to remove them. Screws with green painted heads are removed for normal strip of the set chassis assembly. In general screws with red painted should not be removed for basic dismantling.

The TR-PP-11 has a claimed set-to set range 3 to 8 km (5 miles maximum) subject to the terrain. Its 15 V battery and modest current drain make it an easy set for the enthusiast to power.

**Technical Detail**

Frequency Range	47 to 57 MHz/ 200 possible channels - any channel in any channel switch position
Channel Spacing	50 kHz
Number of Channels	6 individually crystal controlled channels
Number of transistors	17
<b>Receiver</b>	
IF Frequency	Single conversion superhet
Sensitivity	11.5 MHz
6 db Selectivity	0.5 microvolt for 20 db signal-to-noise
70 db Selectivity	± 18 kHz or ± 17.5 kHz depending on the filter used
Unwanted Response Rejection	± 50 kHz
Unwanted Response Rejection	60 db on all frequencies 74 db on IF and image frequencies
Limiter Performance	Less than 1 db output variation between 5 microV and 50mV RF input
AF Output	5mW maximum
AF Distortion	Less than 10% between 300 Hz and 3 kHz
<b>Transmitter</b>	
Average RF Power Output	500 mW (800 mW max.on new battery)
Minimum RF Power Output	300 mW
Modulation	± 10 kHz
Frequency Stability	± 3.5 kHz from -40 to + 55 °C
Unwanted Radiation Attenuation	43 db
<b>Power Supply</b>	
Transmitter Power Drain	French PS.28.A Dry Cell or AA-58/A NiCd battery. Nominal 15 V (16 to 10 V)
Receiver Power Drain	3 W
Battery Life ( PS.28.A)	350 mW
Battery Life ( AA-58/A NiCd)	48 hours on a 9:1 Receive:Transmit Regime
Operating ambient temperature	20 hours on a 9:1 Receive:Transmit Regime
Storage temperature	- 40 to + 55 °C
	- 40 to + 70 °C

**Circuit Description**

Most of the 17 transistors in the TR-PP-11 are mounted in plug-in bases whereas they would be soldered-in in modern equipments. This is an indication that when the set was designed transistors had not been around long enough to demonstrate their life and reliability in service. Another result of the set's design age is that the transistors are mainly germanium P-N-P devices except in stages such as the transmitter power driver and output where N-P-N silicon planar devices are used.

(Module 6) at signal minus IF frequency using an AFY47 transistor. IF selectivity is provided by an 8 pole IF crystal filter (Module 14). In some sets this is ITT type 901FMA, 11.5 MHz ± 17.5 kHz. The IF amplifier (Module 1) consists of 3 off AFY47 IF amplifiers plus one AFY47 IF limiter. The IF signal passes through a discriminator input adapter (Module 2) to an 11.5 MHz crystal discriminator (Module 3). The resultant AF output signal passes to the volume control (Module 12) and is then amplified in an AF amplifier consisting of two 2N526 transistors with a gain of about 36 db (Module 4).



Back case removed showing main chassis and crystal turret

The receiver circuit starts at the antenna where the transmitter PA (power amplifier) tuned circuit acts as the tuned RF input circuit for the receiver. A diode RF (radio frequency) R/T (receive/transmit) switch (Module 13) isolates the receiver input circuits from transmitter output in transmit. It also protects the base-emitter junction of the receiver RF amplifier transistor from voltage damage caused by high power adjacent transmitters. This protection continues to work when the set is switched OFF and does not seriously degrade the receiver noise factor. This form of protection was missing on early PRC-25s.

The diode switch is followed by a single AFY46 RF amplifier. Between the RF amplifier and the AFY46 mixer (both are part of the RF head, Module 9) is a passband circuit consisting of two capacitively coupled circuits each tuned by a separate gang of the tuning condenser. The receiver, therefore, has three RF tuned circuits.

The receiver local oscillator is a crystal oscillator

The transmitter has a two transistor microphone amplifier employing 2N526 transistors and diode clipping (Module 5). The AF output from the microphone amplifier is used to FM modulate an 11.5 MHz AFY47 LC CLAPP oscillator by a varactor diode in Module 8. Module 8 also includes an AFY47 buffer/separator and a 2N384 amplifier. The Module 8 output from the 2N384 amplifier is fed to the crystal discriminator input adapter via a diode switch and generates a frequency error signal against the discriminator crystal. This is used to control the mean frequency of the Module 8 oscillator to 11.5 MHz.

The discriminator input adapter has an external link plug secured by a short nylon cord. Unplugging this link breaks the feed to the discriminator and disables the AFC control of the 11.5 MHz oscillator. This allows the natural frequency of the LC oscillator to be pre-set to 11.5 MHz on test to centralise it in the AFC loop control range. Removal of the plug exposes a centre pin on which a rectified output of the 11.5 MHz signal is provided.

Feeding the 11.5 MHz modulated oscillator back through the discriminator also provides side tone in TRANSMIT to provide a rough check that the set is operational in TRANSMIT. To minimise noise leak in conditions close to an enemy and avoid the risk of acoustic feedback the side tone volume is limited and pre-set. In RECEIVE the 11.5 MHz oscillator is switched off and isolated by a diode switch.



The low level buffered, modulated 11.5 MHz output from Module 8 is mixed with the crystal oscillator signal in a balanced diode mixer (Module 7) to produce the transmitter frequency. Unwanted mixing products are attenuated by a filter at the mixer output. In Module 9 (the RF head) the transmitter signal is amplified in an AFY45 RF pre-amplifier stage, followed by a 2N2222A RF driver stage prior to the final 2N2951 RF PA. A variable antenna loading inductor is ganged to the 5 gang variable capacitor.

### Channel Crystals

One of the sets was crystallized for 47.000, 49.000, 49.400, 50.200, 51.000 and 51.800 MHz. The second had only 5 crystals fitted. These were for 48.000, 48.200, 49.000, 49.400 and 51.200 MHz. The crystals are type CR-31/U, series resonant and, as stated above, crystal frequency is signal frequency less 11.500 MHz.

The British WS 88 and SR A40/C/PRC-26 VHF/FM squad radios both had A and B versions. Each version always had the same frequencies. It does not seem that this was the case with the Portuguese TR-PP-11s. The two sets inspected had the common frequencies of 49.000 and 49.400 MHz possibly common inter squad frequencies. The TR-PP-11 is designed so that all its 200 channels are available with the appropriate crystals so, on present evidence, it is difficult to predict what crystals will be found in a given set. One of the two radios had a label on the inside of the battery compartment cover with a hand written list of channel and crystal frequencies.

### Power Supplies

There was an option to operate the TR-PP-11 from a NiCd battery, French type AA-58/A, 15 volts 0.8 AH. This battery is the same size as the PS.28.A but has about half its capacity. It includes diodes as temperature sensors for charge control.

12 off NiCd cells connected in series give a battery voltage of  $12 \times 1.25 = 15$  Volt

TR-PP-11B TRANSMIT current is  $3000/15 = 200$  mA  
TR-PP-11B RECEIVE current is  $350/15 = 23.3$  mA

The average current on a 9:1 RECEIVE:TRANSMIT regime is:

$$200/10 + (23.3 \times 9)/10 = 20 + 21 \text{ mA} = 41 \text{ mA}$$

The above battery should, therefore, give a life of just under 20 hours/charge. 0.8Ahr NiCd cells, surplus from early generation cellphones, provided a test battery for the set.

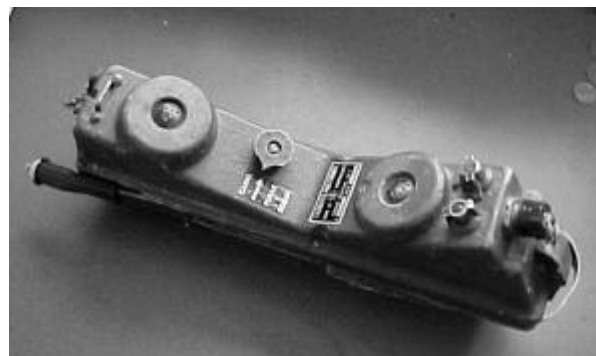
### Conclusions

The TR-PP-11 is a strong, well made set. RF screening is thorough. The designers have made creative use of semiconductor diodes for T/R switching and device protection. The set is a substantial step forward compared with the TR-PP-8-A. Valve filament ageing and microphony are designed out; the operator's portage load is reduced, range and battery life are increased and battery technology is standard and cheap.

### References

'TR-PP-11/TR-PP-13 et versions dérivées'  
Thomson-CSF commercial publication.

MAT 6329 EX TRS 2707 'Manuel de Reparations de Poste Radio de Section TR-PP-11-B', Avril 1971



View of TR-PP11