

The Clansman UK/PRC-351 and its Variants – Part 2

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In part 2 of his article, Murray McCabe looks at variants, such as the PRC-352 and BCC-61, together with various vehicle and transportable installations. He concludes by identifying a number of specific safety risks to avoid when working on this equipment.

PRC-352

The mechanically band switched 20 watt RF power amplifier AM-352 can be used with the PRC-351 in two ways:

- a) Attached between the set and the battery and powered from the set battery. This gives a portage load of 10kg and a battery life of 6 hours.
- b) With its own battery (i.e. two identical batteries are carried, one for the set and one for the RF amplifier). This gives a portage load of 12.5kg and returns the battery life to 12 hours.

The PRC-352 cannot be operated while it is being man portaged. The AM-352 has only a 50 Ohm BNC output socket and requires a device like the TUAAM to match to a whip antenna or a special static ground antenna, suitable for a 50 ohm feed.



Fig.10 AM-352 RF Amplifier

The PRC-352 was originally intended for operation with a lightweight ground mounted monopole, omni-directional antenna, shaped like an inverted skeleton pyramid. It had an overall height of 1m and was of especially light construction for man portage. Two PRC-352s working with this antenna had a set-to-set range of about 16 km. The same antenna could be used with the PRC-351 to provide ranges of about 11 km.

There is little evidence of this antenna in service. It appears to have been replaced with a ground spike antenna with an optional elevated kit.

BCC 543 TUAAM (UK M.O.D. No.TN402)

The TUAAM is primarily intended for vehicle use. It automatically tunes and matches a 2m end fed whip antenna to a 50 Ω output VHF transmitter at any frequency in the range 30 to 76 MHz. Matched VSWR at the transmitter is normally better than 1.2:1 and tuning time less than 5 seconds. Its operational supply voltage is 32 to 22 volts DC and it weighs 3.5 kg.

The TUAAM has more tuned circuits than necessary as a matcher. It provides additional RF selectivity that reduces spurious in transmission and reception. This aids operation of



Fig.11 TUAAM

radio sets in close proximity, for example on the same vehicle.

The maximum RF power on tune should not exceed 20 watts, but once tuned the TUAAM can handle 50 watts. Rough efficiency checks indicate that 20 to 25% of the transmitter output power is lost in the TUAAM.

There are no manual controls on the TUAAM, just RF input and output BNC sockets and a 7 pin supply and control connector. In the unit are more than 50 transistors controlling 3 servo motor driven variable capacitors. The configuration is two inductively coupled tuned circuits with the antenna fed via a variable capacitor from the second LC circuit. The first stage of operation tunes the two LC circuits in sequence against a dummy load resistor in the unit. It is primarily this resistor rating that limits permissible tuning power to 20 watts RF. The tuning of the first 2 tuned circuits is 'silent'. No power is radiated to betray the the radio's position. However, the third stage, the final matching to the vehicle antenna is incomplete.

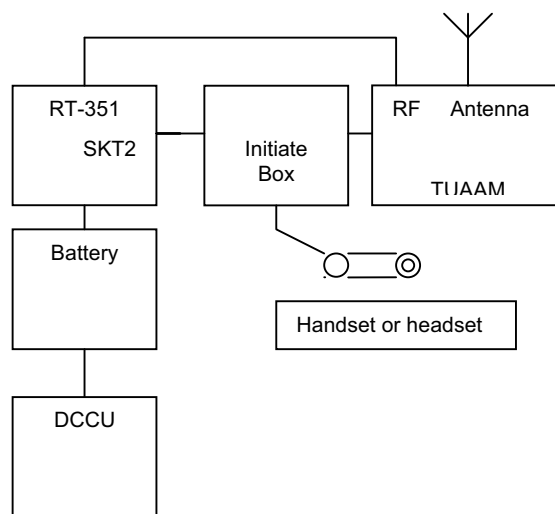


Fig.12 Simplified 'Clip-in' block diagram

In clip-in operation the TUAAM is powered via the Initiate Box from the RT-351 battery, which in turn, is being charged from the DCCU. The normal initiate box was BCC 425. It has a selector switch for 'N' normal or 'S' silent tuning plus a TUNE

button. In 'N' operation pressing and releasing the TUNE button takes the unit through all 3 stages of matching. If 'S' is initially selected only the first 2 stages are completed. The amber pilot light on the initiate box glows for about 3 seconds during the tuning sequence. If the bulb lights for about 10 seconds there is an equipment or connection fault.

If a 'S' matching operation is performed, the antenna will be connected before final impedance matching but reception will still be possible. When radio silence can be broken switch to 'N' and press the TUNE button. The stage 3 final matching will occur in about 1 second.

Transmitter Receiver, BCC 61 (5821-99-630-6155)

The BCC 61 together with pilot's control box D692/1, Interface Unit BCC 556, Power Supply BCC 534, TUAAM BCC 543 and a 1.7m aircraft whip aerial with an integral impedance matching transformer combine to make Helicopter radio BCC 306. The BCC 306 had the RAF designation ARI-23258/1. It is an RT-351 transceiver with the switches to set the frequency, whip antenna base and battery toggle clamps removed. A 19-way connector is mounted in their place to allow the set controls to be cabled to, and electrically operated from, the remote pilot's control box.

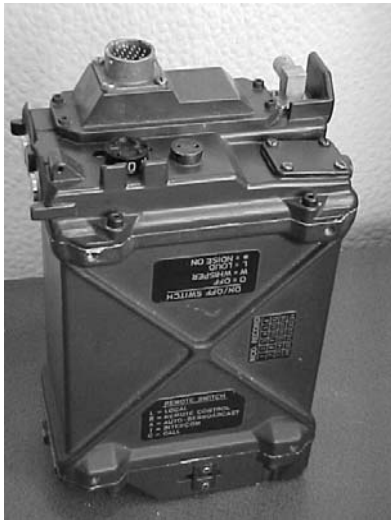


Fig.13 BCC 61

The BCC 306 was originally intended for Wessex helicopters with 24V supplies but could be made available for other voltages. It provided air liaison with ground units at distances of 30+ km from aircraft flying at 100m over open country. The US AN/ARC-44 valve set had previously provided this capability. This set had 100 kHz channel spacing and covered from 24 to 52 MHz. The ARC-44 worked with the PRC-10 series and similar NATO sets including VHF/FM Larkspur equipments but it was not compatible with Clansman VHF/FM radios. It had inadequate frequency coverage and its transmitter frequency stability relied, in part, on a free running LC oscillator.

VRQ-301

Introduced in 1976, the VRQ-301 is a vehicle version of the RT-351, intended for use in AFVs, soft-skinned vehicles or helicopters in which duties it can provide radio communications plus intercom facilities. The main difference between it and the BCC 306 is that the controls remain on the set where they are locally, mechanically adjusted. The set cannot be tuned remotely.

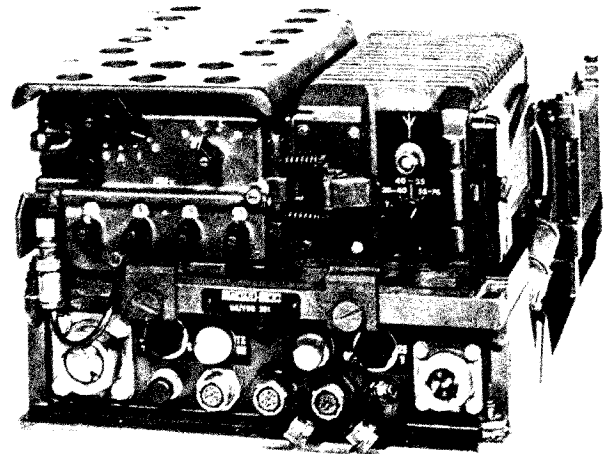


Fig.14 VRQ 301 HP

The design philosophy adopted was to use a standard PRC-351 and to bolt external hardware to it. A front panel assembly was bolted to the PRC-351 with extended knobs that engaged with the tops of the existing digital frequency setting switches and the FUNCTION switch. The front panel assembly also contained a knob for the rear mounted REMOTE switch plus an extended mechanical drive to the rear of the set. This bolted on top of the REMOTE switch knob and allowed it to be controlled from the front of the set. A robust perforated plate was fitted to the set 'top', i.e. over the ON/OFF and REMOTE switch labels. This provides mechanical protection, especially for the REMOTE switch drive, and ensures cooling in AFV applications where the set top can be used as a shelf or a step for combat boots. These 'bolt-ons' account for most of the tapped holes on the outer surfaces of the set casing.

The VRQ-301 system hardware is similar to that of the BCC 306 helicopter set, i.e. the PRC-351 with 'bolt-ons', as above, the 20 watt AM-352 RF amplifier as an option, the BCC 543 TUAAM, the BCC 534 Power Supply Unit which is electrically similar to the BCC 306 PSU but operates over a wider supply range of 20 to 33Volts DC. Finally there is the BCC 550 vehicle interface box.

Without the AM-352 the set is called the VRQ-301 LP with the AM-352 it is designated VRQ-301 HP.

VRQ-301D



Fig.15. VRQ-301D

The VRQ-301D is a transportable set intended for operation in hard to reach sites. The set is sometimes remotely

controlled, generally in an air defence role. It is built into a tubular metal space frame and includes the RT unit with bolt-ons as used on the VRQ-301, the 20 watt AM-352 RF amplifier, the BCC 543 TUAAM, vehicle type whip base, two batteries, charger unit (number unknown) and the BCC 553 interface unit.

BCC 307 Clip-in and Portage

Racal originally produced the BCC 307 clip-in arrangement based on use of the light weight Clansman (or Para.) pack frame, plus the TUAAM, the TUAAM initiate box and the BCC 528 battery charger. The radio and the pack frame plus its portage webbing, all clipped into the vehicle mounting. The pack frame with webbing weighed 1.4 kg. The pack frame itself had limited robustness for field service and was easily bent. Conversely, the French TR-PP 13 and others had demonstrated that a pack-frame was not necessary for a man-pack.



Fig.16. Open Rucksack showing set straps

As a solution the military adopted the stronger, heavier, GS Mk.2 pack frame and an adaptor plate assembly that was held to the GS pack frame with 'tap head' type butterfly nuts. The radio was bolted to the adaptor plate. For clip-in operation the adaptor plate with radio was removed from the pack frame. Its butterfly nuts were then used to clamp the radio and adapter to a Dexion mounting in the vehicle.

The weight of GS pack frame, adaptor and webbing was 3.1 kg. A prime requirement of a man-pack radio is that its load on the soldier should be minimised. Racal had gone to significant trouble to hold the weight of the basic radio plus its battery down to 6.24 kg. It seems illogical to add 3.1 kg of the GS pack-frame so increasing the soldier's load by 50%. This was especially so when the GS pack-frame was only necessary to cater for the rare event that the radio might be required for clip-in duty.

Recent newsreels seem to show good sense ultimately prevailed. PRC-351s are seen carried in unframed



Fig.17. Closed Rucksack

rucksacks such as Rucksack Radio Carrier DPM 5820-99-869-2113. This rucksack is suitable for use with Radios PRC-320, 350, 351, 352 and Cougar. It has a substantial back pad, internal straps for all these radio types, an internal pocket for a spare antenna, space for additional gear and an external pocket for a spare battery. It also has robust external zips to allow large, optional side pockets to be attached. It is 'man-pack only' and weighs little more than 0.5 kg.

HEALTH WARNINGS

The insulated washer of the RF power transistors in the RT-351 and AM-352 are made from beryllium oxide. This material is highly toxic and must be handled with extreme care to avoid breakage and/or ingesting or breathing in particles of the substance.

The meter of the SURF 4W is illuminated by a radioactive source. There is reputed risk from contamination if the 'radioactive bulb' ruptures in a workshop or similar confined space. Caution is counselled.

In his article on battery refurbishment Colin Guy warns that leakage from defective cells can contain Potassium Hydroxide, which is poisonous.

It is inadvisable to stand close to the antenna of a PRC-352 for more than several minutes when it is transmitting.

Acknowledgements

My thanks to John Teague for the photograph of the VRQ-301D space frame and to all VMARS members and friends who helped me learn about the RT-351.

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