

## Clansman combat net radio

The Clansman family of Military Radio Sets comprises nine main radio units, operating in the High Frequency (HF), Very High Frequency (VHF) and the Ultra High Frequency (UHF) Radio Bands.

RADIO STATION	FREQUENCY RANGE (MHz)	RF POWER OUTPUT (W)	Approx. range (km)	miles
<b>VEHICLE</b>				
<b>UK/VRC 321</b> (also as ground station)	HF USB CW 1.5-30	40	with 7.9 m antenna: 50 km dipole/end-fed antenna: 50-200 km	30 30 - 120
<b>UK/VRC 322</b>	UHF AM 1.5-30	300	Ground wave: 100 km Sky wave: 600 km	60 370
<b>UK/VRC 353</b> (also as ground station)	VHF FM 30-75.975	50	with 1.9 m whip aerials: 30-50 km elevated whip or ^ antenna: > 50 km	20 - 30 > 30
<b>MANPACK</b>				
<b>UK/PRC 320</b>	HF USB AM (LSB with mod) 2-30	30	with 2.4 m whip aerial: 35 km with 7.9 m antenna: 50 km dipole/end-fed antenna: 50-200 km	20 30 30 - 120
<b>UK/PRC 344</b>	UHF AM 225-399.95	2	Overground: 8 km Ground-to-air: 160 km	5 100
<b>UK/PRC 349</b>	VHF FM 37-46.975	250 (mW)	with 0.5 m/1 m whip aerials: 0.3/0.5 km urban, built-up areas 1.2/1.5 km wooded countryside 2.0/2.8 km rolling countryside	500 yds 0.7 - 0.9 1 - 1.7
<b>UK/PRC 350</b>	VHF FM 36-56.975	2	with 1.2 m whip aerial: 2-4 km	1 - 2.5
<b>UK/PRC 351</b>	VHF FM 30-75.975	4	with 1.2 m whip aerial: 4 km urban, built-up area 3-7 km wooded countryside 10-13 good site open countryside vehicle with 2 m whip: 17 km	2.5 2 - 4.5 6 - 8 10
<b>UK/PRC 352</b> (ground station use)	VHF FM 30-75.975	20	with ground spike antenna: 5 km urban, built-up area 9 km wooded countryside 16 km good site, open countryside vehicle with 2 m whip: > 28 km	3 5.5 10 > 17

### Vehicle radios

**HF VRC 321** This vehicle-mounted radio equivalent of the PRC-320 was used as a SSB (USB) ground station and 4m antenna. It was good for inter-company communications outside of the normal working range of the VHF forward area nets, and for rear link communications to Brigade level. The 321 can be linked, using standard Coaxial cables, to a SURF to avoid interference with other HF Radios nearby; and a TURF to tune the radio to the attached antenna. Modes of operation are USB/AM/CW. The VRC 321 provided a useful backup 'guard' net, since the VHF sets are prone to jamming. They can also be used for CW (morse) transmission. It is versatile and simple to operate, but requires lower an LSB modification for use with lower HF amateur bands below 10MHz (e.g. **60 m @ 5Mhz**). RF output is 20 - 30 Watts.

**HF VRC 322** is a 321 set with a 300 Watt PEP linear amplifier (ARF 250W) plus a TURF 250 used with additional antennas to give greater range. Both groundwave (range up to 40 km) and skywave radiation can be achieved (giving ranges up to 1000 km using Near vertical Incidence Skywave, and beyond 2500 km, using single and multi-hop skywave).

**VHF VRC 353** is a vehicle-borne radio for communication between brigade/battlegroup HQs and front-line forces. Suitable for rebroadcast, it can be used with an elevated broadband vertical dipole mounted on an 8-metre mast. Typical power consumption is 3A on Rx and maximum 10A on Tx at 24V DC. The 353 operates from 29MHz (with mod) to 76MHz, the same frequency range as the PRC 351/2 with RF power up to 50 Watts. Antenna systems are provided to provide improved performance in semi-static situations such as an elevated broadband vertical dipole mounted on an 8 metre mast. The VRC was also capable of data transmission and when used in conjunction with an add-on Digital Master Unit, providing medium level secure speech network. Licenced amateurs may prefer to bypass the ATU to fit a more efficient antenna cut for the 4 or 6 metre bands, see **MOYMK**, who also suggests disabling the 150Hz to avoid complaints about poor modulation from users on 4 meter (70.0 MHz to 70.5 MHz) & **6 metre** (UK = 50 and 52 MHz; US = 50 MHz to 54 MHz) bands using civilian sets.

## Manpack radios

**HF PRC 320** is a versatile intra-company manpack radio (although it can also be mounted in vehicles) with an integral ATU, intended for communication between HQ and front-line forces down to company level. The whip antenna is used for **groundwave** comms, and the **dipole antenna** can be used for NVIS HF **Skywave** operation on the 60 metre (5MHz) allocations. A number of different antennas are available for different circumstances and needs. Typical power consumption is: 150 mA standby Rx; listening 175 mA Rx; low HF output 1.2 A Tx [3W Morse on CW]; high HF output 2.5 A Tx at 30W. The output power is selectable between 3- 30 watts. The Yugoslav (thick-fin) version PRC-320L [Kornjaca =Turtle] is sought after because it was manufactured with in-built LSB. Otherwise, the PRC 320 - like other Clansman HF radios - requires the LSB 'mod' for use with lower HF amateur bands. It has an RF output of about 7 watts on AM and 30 watts on SSB. The 320 is portable, but check the tuning once loaded in the backpack, since ground conductivity/body capacitance can rapidly change: the pack you tuned on the ground may well be out of tune when used on your back. The 320 can also be used as a ground station with a dipole antenna attached to two masts for long-range communication (with the bounce effect of the ionosphere giving world-wide communication given optimum frequency and time of day). The PRC320 features a built-in TURF (Tuning Unit Radio Frequency) unit for tuning the radio to the attached antenna.

**UHF PRC 344** with a built-in homing beacon, it was issued to forward air controllers in contact, for use with ground attack aircraft, cas-evac, landing zone comms and the like. There are no amateur bands within its frequency range.

**VHF PRC 349** was issued as an intra-section portable 12v DC-powered radio at platoon level. RF power output is 0.25 watts. Units supplied to the British Army operate in the 37 – 46.975 MHz range, voice (FM) transmission Mode. A high power (2 Watts) output version was also available and any 10 MHz block in the range 30 – 76 MHz could be supplied. Widely used (legally) by cadet forces, but no legal amateur bands available.

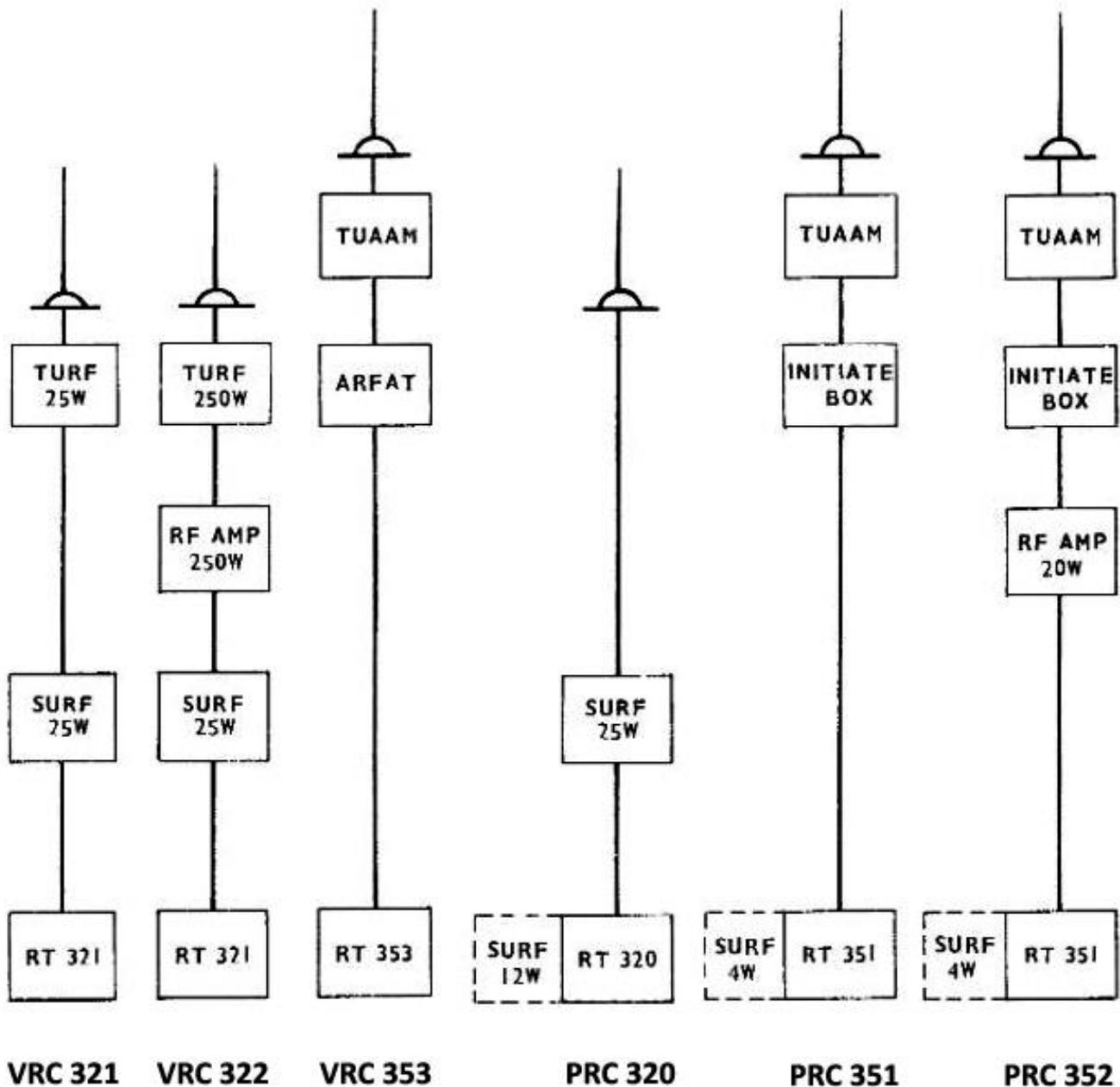
**VHF PRC 350** was intended for use as a short-range VHF Set at platoon and section level. Like the PRC 349, it is powered by 12-15v DC. Volume and squelch levels are pre-set and cannot be changed by the operator. This low-powered set can only be used by UK amateurs on the 6 metre band on lower VHF between 50 Mhz and 52 Mhz. This radio cannot be used with a TUUAM.

**VHF PRC 351** is an intra-platoon level backpack VHF FM transceiver. It operates in the 30-75.975 MHz range with a possible 1840 channels. The PRC 351 has 4 watt RF power output, and covers the 4, 6 and metre bands, 29MHz (with mod) to 76MHz. However the 25 kHz channel steps do not allow access to the 6 metre calling channel etc which is based on 10 kHz increments! Fortunately many military radio enthusiasts have now established 51.600 MHz as a calling and working channel. This is in the FM wide deviation (12.5 kHz) segment of this band. An alternative channel of 51.70 MHz is often used by amateurs with military vehicles at shows and rallies. Battery drain is 105mA on receive and 800mA on transmit, which will enable up to 12 hrs use at a Rx:Tx of 9:1. The PRC 352 is identical, with the addition of a 20 watt RF amplifier and can be used as a ground station.

**VHF PRC 352** A 351 set with additional 20W RF amplifier connected by a short coaxial cable. When used in the manpack role the amplifier is always switched off and the standard whip aerial connected. This is mainly because of the critical aerial match required by the amplifier, which switches out of circuit if the correct impedance range is not presented. There is also the safety consideration that the operator would be too close to the relatively high RF field. When used in a vehicle the RT352 is connected to an Initiate Box via the second 7 pin audio socket SKT2.

The **HF PRC 319** was also made as a Special Forces and STA (Surveillance and Target Acquisition) Patrol man-portable, patrol level radio HF/VHF, half-duplex transceiver. Features include key-pad entry of frequency, mode and data with digital LCD display; 10 pairs of pre-programmable channels from 1.5 - 40 MHz in USB, CW and Data mode, allowing short range VHF communications overlapping with the other clansman series radios on the higher frequencies.. The half-duplex operation with the option of transmitting and receiving on different channels; the option of using a removable pocket sized electronic message unit (EMU) to transmit and receive short data communications; a fully automatic antenna tuner which can be remotod up to 50m from the set using standard co-ax cable; Self test facility. Power output is 50 watts PEP on high power setting with an adjustable low power of 2.5 watts.

With the Vehicle based units, extension equipment is available to enhance and further the use of Clansman equipment. These units popularly include:



**A TURF** (Tuning Unit Radio Frequency) is a manual antenna tuning unit (with tuning tables printed on the side) for a wide range of HF antennas. The TURF is used to artificially lengthen the antenna (or tune it) for often at HF wavelengths an antenna would be physically too long to attach to a radio without affecting portability and manoeuvrability. In theatre they take much longer to set up and are visible from a long distance away. A TURF unit can be used both to artificially lengthen shorter antennas, and fine tune all HF antennas to exactly match the frequency in use. TURF units are considered mandatory when using 321 sets, and thus are built into PRC 320 sets as standard. A TURF can actually also be used with the RT320 (coax connection from 320 TX O/P to TURF input) in place of the internal tuner, since the 320 tuner supports only wire antennas but the TURF has both wire and coax outputs. TURF units are not built into VRC 321 sets, since a coax cable cannot be connected directly to the antenna (example – whilst using a sloping wire or vertical radiator). The TURF needs to be attached directly to the antenna, and thus removed from the vehicle.

**The TUAAM** (Tuning Unit Automatic Antenna Matching) is an automatic VHF ATU (Antenna Tuning Unit) so a fixed length antenna outside the vehicle can be used on any frequency between 30 and 80 MHz without going outside to adjust it! The TUAAM is essentially a TURF but for VHF. The TUAAM automatically tunes the antenna, and artificially shortens it rather than lengthening it, but essentially it performs the same function as a TURF.

TUUAMs are used with the VRC 353 in conjunction with an [ARFAT](#) (Apparatus Radio Frequency Antenna Tuning) which reduces transmitter power until the TUUAM has matched the antenna and also with the RT351/2 sets in conjunction with an Initiate box that manually keys the radio and starts the tuner at the same time. The ARFAT contains some control electronics with temperature sensing and a thick film dummy load to allow the 50 Watt RT353 to be tuned under radio silence conditions. This addition is necessary as the TUAAM only contains a very basic load just capable of dissipating the 20-Watts or so from an RT352.

[A SURF](#) (Selector Unit Radio Frequency) is an electrical filter, designed to reject unwanted interference from other radios when operating in close proximity to each other. For each radio, Clansman uses PRC351/2 (SURF 4 Watt) and also the HF PRC320 (SURF 12 Watt) and VRC 321 (SURF 25 Watt). The SURF is installed between each set and its TURF or TUUAM. The SURF is tuned using a manual control on the front of the unit, so that only the frequency in use, and those close to it, are processed by the TURF and antenna and accepted by the set. They are only used in the dismantled role, and should be disconnected when the radios are used mounted within vehicles.

**IBRU** - Used in conjunction with the "Harness" point on VRC 353 and VRC 321 units, to operate 2 or more sets as a Rebro. (ReBroadcast). Re-Broadcasting allows 2+ networks, on different frequencies, to be combined, effectively increasing the ground size of the net. For instance, a vehicle using whip antennas may only be able to communicate 30km. Placing a Rebro vehicle 30km away could extend this to 60km by re-broadcasting the signal on a second net.

Part of the problem with military VHF radios is the low frequency. They are very good for large open areas, but less so for built up areas like towns and cities. This is why the blue light services (police first) changed to UHF and VHF high band systems. UHF radios also have much smaller antennas, so making covert use (e.g. by forward air controllers) much easier. The VRC 353 used 50 Watt high power RF to overcome enemy jamming.

One downside of the Clansman HF radios is that you have to dial in a frequency and can't as easily browse the bands with a variable frequency oscillator, as with modern amateur radios. For HF work they ideally require modification to allow lower side band to provide the full range of use. Nevertheless, Clansman radios are well-designed for military use on pre-defined frequencies. The following wavelength ranges are designated for use by licensed radio amateurs:

1.8-2.0 MHz	(160 metres, MF)
<b>3.5-3.8 MHz</b>	<b>(80 metres, HF)</b>
5.3-5.45 MHz	(60 meters, HF)
<b>7.0-7.3 MHz</b>	<b>(40 metres, HF)</b>
10.1-10.15 MHz	(30 m, CW Morse only)
<b>14.0-14.35MHz</b>	<b>(20 meters, HF)</b>
<b>21.0-21.450 MHz</b>	<b>(15 metres, HF)</b>
24.89-24.99 MHz	(12 metres, HF)
<b>28.0-29.7MHz</b>	<b>(10 meters, HF)</b>
<b>50-52 MHz</b>	<b>(6 metres, UK VHF)</b>
<b>70-70.5 MHz</b>	<b>(4 metres, VHF)</b>
<b>144-146 MHz</b>	<b>(2 metres, UK VHF)</b>
430 to 440 MHz	(70 cm, UHF)

These bands are split in to segments for various kinds of transmission - in general Morse code is at the low end and SSB speech is at the high end. Bands below 10MHz are generally used with lower side band (LSB) and above 10MHz with upper side band (USB) - Clansman sets in UK service only had USB so are more likely to be found above 10MHz unless the owners have converted them. In practice most UK stations use 3.5 and 7MHz for daytime traffic within the UK - 7MHz works better in the afternoon - and the bands from 14MHz upwards are better for long distance use.

See [this table](#) for the International amateur radio frequency allocations

The sets that can legally be used by amateurs are: The VHF **PRC-351/352** and VHF **VRC-353** all cover 30 to 76MHz FM only. This includes the 50-52MHz band mentioned above and also the 70MHz band at 70.450MHz. The HF sets (**PRC-320**, **VRC-321**, **PRC-350**) operate from 1.5 to 30MHz using USB SSB.

Clansman sets are incompatible with default amateur use of lower side band below 10MHz unless modified.

Of these, perhaps the most useful and most popular, but also most expensive, is the PRC 320. This is a HF manpack covering 2 - 30MHz in 100Hz steps, AM, CW and USB at 30W. It can be easily modified for LSB. Its only drawback is its decade switch tuning. These sets were not designed for trawling the bands!

The PRC 320 has a built-in manual ATU and standard end-fed antenna wire spools and masts however, which make this a potent set. The whip antenna and spring-loaded gooseneck can be rotated 90°, so that the radio can be used upright, or on its side (more stable).