

PERSONAL ROLE RADIO 4.0

The Personal Role Radio (PRR) 4.0 is a lightweight, secure, handheld UHF radio with an operating bandwidth wide enough to provide worldwide operation, designed to aid the performance of small unit infantry operations i.e. squad / platoon operations.

PRR 4.0 consists of a secure programmable transceiver with rechargeable and non-rechargeable batteries and a range of accessories.

- > PRR 4.0 provides 64 programmable memory channels in both the primary digital mode and the FM mode that meets the 12.5 kHz narrow band requirement.
- > PRR 4.0 is of submersible construction and meets MIL-STD-810.
- > PRR 4.0 operates in the UHF frequency band and has enough band range to selectively program approved

frequencies in the 380 MHz to 430 MHz or 410 MHz to 470 MHz bands for worldwide operation in both digital and analogue FM modes.

- > PRR 4.0 has an internal audio speaker and microphone with a primary Push to Talk (PTT) button on the side of the radio. A secondary PTT button can be used to key a radio attached to the U-229/U 5-pin connector when used with a headset.
- > PRR 4.0 offers enhanced security using AES 256 bit encryption in digital mode.
- > PRR 4.0 provides operation over a distance of 1 km (0.62 mile).



GENERAL

PRR 4.0 is a software-reconfigurable radio operating on a digital hardware platform. It is currently able to operate in two modes, selectable from the front panel:

- > Digital direct mode
- > Analogue FM mode (for interoperability with legacy radios)

The hardware platform is ideally featured for technology insertion/enhancement by incorporation of additional software for further modes of operation.



PRR 4.0 is capable of storage/operation in the following environments:

- > Operating temperature: 30 °C to +60 °C (22 °F to +140 °F)
- > Storage temperature: 30 °C to +60 °C (22 °F to +140 °F)
- > Humidity: 0 to 100% RH tending to saturation.
- > Operating altitude: 4572 m (15,000 feet)
- > Immersion: 30 minutes in 0.914 m (3 feet) salt water
- > Shock: MIL-STD-810E/F, Method 516.4/5, procedures I/IV/V
- > Vibration: MIL-STD-810E/F, Method 514.4/5, procedure I, category 20
- > PRR 4.0 T3 radio is EMC-qualified to ETS 300 279.
- > PRR 4.0 will withstand periods of heavy precipitation consisting of 4.5 cm (1.8 inches) of rain per hour with 65 kph (40 mph) winds.
- > PRR 4.0 will withstand blowing sand particles in wind speeds of 1737 metres per minute (5,700 feet per minute) and dust in wind speeds of 530 metres per minute (1,750 feet per minute) without loss of signal strength and is sealed to prevent any blocking, clogging or seizing of moving parts
- > Low Probability of Intercept (LPI) is provided by PRR 4.0 in digital mode by use of 256-bit AES end-to-end encryption.



DESIGN

PRR 4.0 is a multi-mode radio that will normally be operated using digital direct mode incorporating 256-bit AES end-to-end encryption. It also has a conventional analogue FM mode for interoperability with legacy unencrypted FM radios.

PRR 4.0 is a robust handheld portable radio contained in a rugged aluminium case with keypad and display. Integral to the case are a microphone and selectable earphone/loudspeaker and a dual PTT, mounted one above the other on the side of the case in an easy-to-operate position.

The integral microphone and selectable earphone/loudspeaker allow PRR 4.0 either to be held to the ear like a cell-phone or in front of the face as with Professional Mobile Radio (PMR) equipment.

Alternatively, PRR 4.0 can be used with a separate military microphone/headset connected via a 5-pin U 229/U connector.

When a separate microphone/headset is connected, the internal microphone and earphone/loudspeaker are automatically disabled.

A second U 229/U connector enables connection of an external radio, keyed via the integral second PTT. When an external radio is connected, its received audio is heard in one of the earpieces of the separate military headset, with PRR 4.0 received audio heard in the other.

A Patented Wireless PTT (WPTT) is supplied, avoiding the need for the user to operate the integral PTT switch on PRR 4.0. The WPTT is powered by a disposable battery and has a battery life of at least 24 hours. In operation the WPTT is associated with a particular PRR 4.0 to prevent inadvertent operation of a nearby PRR 4.0. The operating distance of the WPTT is from 0 to 1 metre (0 to 3 feet).

Its attachment capability is sufficiently flexible to enable it to be attached to any convenient part of the user's weapon or other mission equipment, including on to the Picatinny rail, thus allowing maximum concentration to be applied to the military mission.

The PRR 4.0 keypad has the capability to lock all settings to prevent inadvertent changes. The keypad also contains the capability to cause the STUN or KILL of other PRR 4.0s where they have been compromised. A radio that has been stunned can be re-commissioned over the air, whilst a radio that has

been killed needs to be returned to a secure workshop to be re-commissioned.

A programmable transmitter timeout duration is included. A further capability is the option to require the entry of a password for power-on.

A fully featured display, in conjunction with the keypad, allows selection of other PRR 4.0s for calling in digital mode. The display backlighting can be switched off and read with Night Vision Goggles. In analogue FM mode the channel number can be selected.

A full set of menu options allows access to help facilities, short text message facilities (digital mode) and configuration settings (e.g., backlight on/off, LCD contrast, warning sound options, earphone/loudspeaker mode, digital/FM mode). The keypad can be locked to prevent access to functions by the average user, hence providing a simple MMI mode.

In operation the display provides an indication of battery level and the transmitter identity of received signals.



TECHNICAL CHARACTERISTICS

Weight and Volume

The weight of PRR 4.0 is 320 g (0.7 lb) including the battery. The dimensions are 61 mm (W) x 154 mm (H) x 34 mm (D) (2.4 x 6.1 x 1.3 inches) and the radio will fit in a standard M16 Magazine pouch. The volume is approximately 230 cm³ (14 cubic inches). All dimensions are less the antenna.

Reliability and Maintainability

The PRR 4.0 transceiver has a predicted MTBF of 45,000 hours (MIL-HDBK-217F Notice 2, Ground Fixed environment at 25°C).

Power Input

PRR 4.0 uses two 2000 mAH Lithium Ion batteries and will operate for 24 hours based on standard usage (5-5-90) transmit- receive- standby. The radio has a rapid recharge system capable of using a range of AC voltages from International power sources or 12V / 24V DC. PRR 4.0 has an interchangeable alkaline battery pack that does not alter the size, shape or configuration of the radio. Both battery packs are waterproof.

Power Output

PRR 4.0 provides a power output of 1W in both digital and FM modes. The output power amplifier of PRR 4.0 is linearised using Cartesian loop techniques. The inclusion of a linearised amplifier enables PRR 4.0 in digital mode to use a more efficient modulation scheme ($\pi/4$ DQPSK) than would be possible with a conventional UHF power amplifier. This modulation scheme has good demodulation performance, thus maximizing the range achievable in digital mode.

Modes of Operation

PRR 4.0 operates on single or two-frequency simplex with the capability of operating in a group call scenario allowing a one to many type of operation equivalent to a conference call but using PTT. The group call facility allows multiple simultaneous transmissions. The radio provides a digital direct mode of operation and an analogue 12.5 kHz or 25 kHz FM mode allowing flexibility of operation and an interface to legacy UHF equipment.

The mode is selectable from the keypad as a manual function; and is designed to not automatically change. This provides a level of control so that the user will always know what information is being transmitted or received on his network, and safeguard that level of security.

Information Security

PRR 4.0 in digital mode provides end-to-end encryption of voice using a FIPS 140-2 standard compliant AES encryption software module employing a 256-bit length key.

The AES implementation is subject to an approval process via a United Kingdom Commercial Evaluation Facility (CLEF) and provides anti tamper protection and Key clearance facilities suitable to enable NIST compliance up to Security-Level-3 of NIST FIPS 140-2.

PRR 4.0 may contain up to 5 x 256-bit Keys thus enabling support of mission requirements. Key variables can be loaded for separate supersessions.

This digitised voice structure provides the ability to apply the required AES encryption simply by passing the digitised voice through an additional encrypting software module located within that structure.





This approach has the benefit of minimizing potential weight and power consumption increases required to implement the AES encryption by adopting and building in additional hardware modules such as modems etc.

Interfaces

PRR 4.0 provides a standard military 5-pin wire connection to interface with legacy systems via a connector on the base of the radio. A dual PTT switch is provided on PRR 4.0 to control a second radio. An antenna socket is available on PRR 4.0.

Interoperability

PRR 4.0 provides a dual PTT switch capability and an interface to a standard U/229 connection. PRR 4.0 is usually operated in AES-encrypted digital direct mode.

The radio also provides an analogue UHF (380 MHz to 430 MHz or 410 MHz to 470 MHz) 12.5 kHz or 25 kHz FM mode for interfacing with legacy unencrypted radio systems such as the Army Icom F43 radio in unencrypted mode.

Exterior Colour Scheme

The exterior surfaces of PRR 4.0 radio are constructed of low reflective materials or are finished with a low reflected protective coating. The exception to this is the display element of the radio that is approximately 50mm by 38mm in dimension.

Display, Knobs, and Controls

PRR 4.0 is Night Vision Goggle (NVG) compatible having a Graphic (96 x 94 pixel) display, with selectable backlighting, capable of displaying three lines of 11 characters. Easily identifiable shaped knobs are provided for volume and group / channel select. Two easily identifiable PTT buttons are provided on the side of the radio with an optional emergency call button on the top of the radio.

A telephonic standard keypad is provided with six programmable function / navigation keys. The keypad can be locked to prevent accidental changing of the settings.

The radio can be operated during night time and blackout conditions.

OPERATIONAL CHARACTERISTICS

The operational characteristics for PRR 4.0 are detailed in the following sections.

Low Probability of Interception (LPI)

The use of end-to-end AES encryption as well as Air Interface (AI) encryption and authentication provides PRR 4.0 with a Low Probability of Interception (LPI) of User Voice traffic.

Antenna

The antenna used by PRR 4.0 is a flexible UHF quarter wave approximately 16.5 cm (6.5 inches) long covering the specified frequency range of the UHF radio band (380 MHz to 470 MHz).

This antenna gives a 3 dB advantage over typical helical type antennas, having a gain of 0 / 1 dB over a dipole, to give an enhanced LoS communications range. A standard helical antenna is available if a physically shorter (5 cm [2 inches]) option is required.

Operating in Biological/Chemical Warfare Environment

PRR 4.0 has been specifically designed to ensure that it is fully capable of being operated while wearing any level of Mission Oriented Protective Posture (MOPP) clothing.

DESIGN AND CONSTRUCTION

Decontamination

PRR 4.0 has been designed such that surface indentations are minimized and the keypad sealed to avoid entrapment of biological and chemical contamination. In addition, all exterior surfaces are constructed of materials that can tolerate exposure to Decontamination Solution number 2 when applied with the M12DAP decontamination unit.

Safety

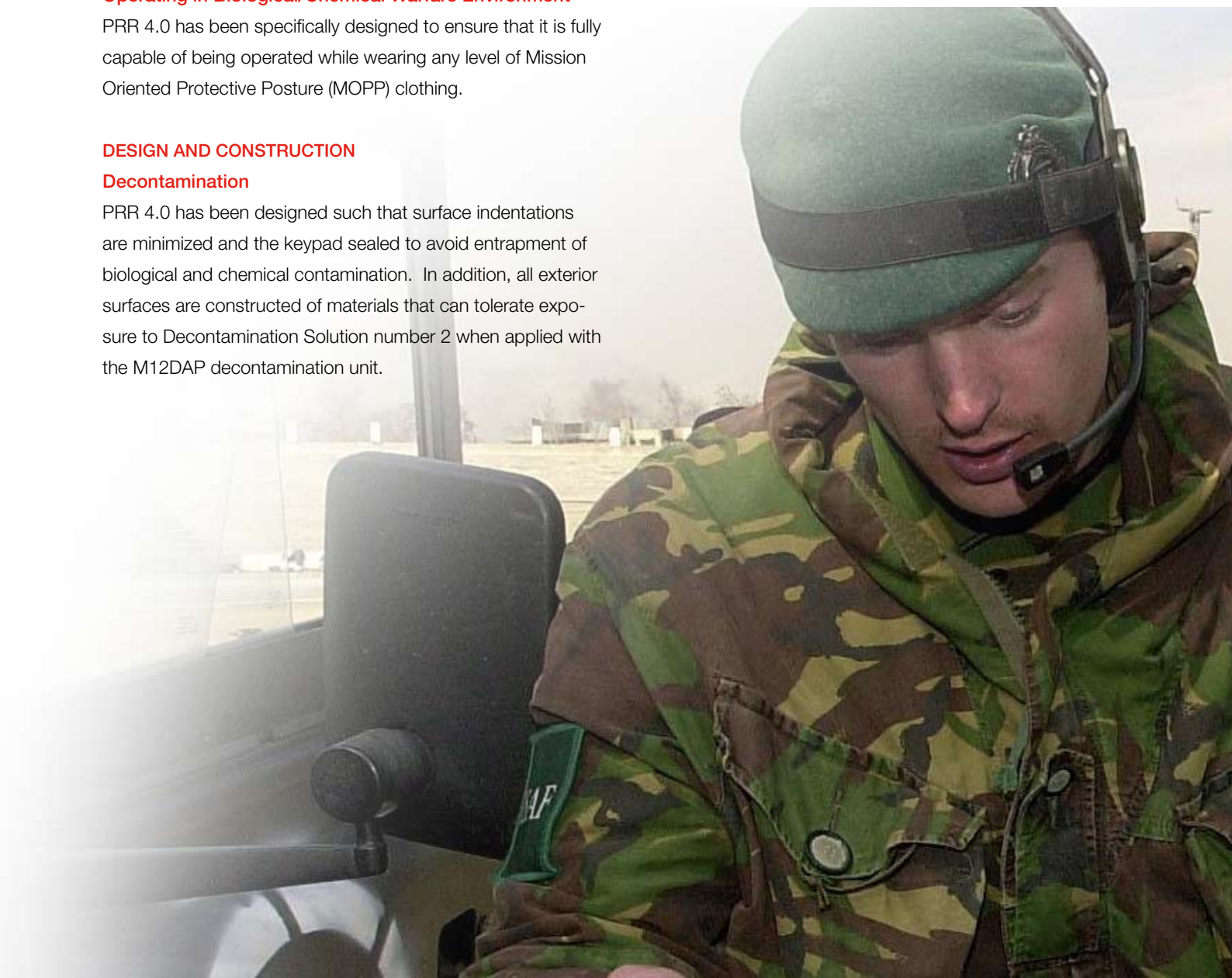
PRR 4.0 has already been subject to a rigorous safety evaluation as part of its development and has been determined to be free of any hazards, which could cause serious injury or death to operators or maintainers.

Hazardous Materials

PRR 4.0 and its support environment, has been designed to avoid the use of hazardous substances during manufacture. Where this has not been possible components have been selected to meet existing National and International Environmental Standards.

Manpower and Training

PRR 4.0 is a simple to use radio with headset and remote wireless PTT accessories. These are designed for ease of use with minimal training required.



TECHNICAL SPECIFICATION

Equipment type	Handportable
Power class	Class 4 (1W)
Power control	Open Loop and Closed Loop in steps of 5 dB from 0.03W to 1W
Modulation	$\pi/4$ -DQPSK
Power on adjacent channel	Compliant with ETS 300 392-2
Vector error RMS value	Compliant with ETS 300 392-2
Static RX sensitivity	Compliant with ETS 300 396-2
Dynamic RX sensitivity	Compliant with ETS 300 394-1
RX Class	A, B
Frequency bands	380 to 430 and 410 to 470 MHz
RF channel spacing	25 kHz
Power supply	Li-Ion 2000 mAh 3.7V
Battery endurance	About 14h with duty cycle 5 / 35 / 60
Data terminal interface	Standard Peripheral Equipment Interface (ETS 300 392-5)
Speech Codec	Standard Speech Codec (ETS 300 395)
Max. audio power	1W on 8 Ohms
Data rate	Up to 28.8 kbit/s half duplex



ENVIRONMENTAL SPECIFICATION

Climatic condition	ETSI EN 300 019-1-7 (-30 °C to +60 °C [22 °F to +140 °F])
Conformance testing specifications	ETSI EN 300 394-1 (-30 °C to +60 °C [22 °F to +140 °F])
Water and dust protection	IEC 529 class IP54
Mechanical conditions	ETSI EN 300 019-1-7 & IEC 721-3-7 Class 7M3
	MIL STD 810 E/F Method 516.4/5, procedures I / IV / V
	MIL STD 810 E/F Method 514.4/5, procedure I, category 20 (Vibration Tests for US highway truck transportation and composite wheeled vehicle transportation)
	EN 60068-2-32 Free fall 1 metre height onto concrete surface
Transportation Temperature	ETSI EN 300 019-1-2 Class 2.3

DIMENSION AND WEIGHT

Size (H x L x D)	61 mm (W) x 154 mm (H) x 34 mm (D) (2.4 x 6.1 x 1.3 inches) (with standard battery, without antenna)
Volume	230 cm ³ (14 cubic inches) approx. (with standard battery, without antenna)
Weight	320g (0.7 lb)

AUDIO SIGNALS

Incoming call	Incoming speech call
Emergency ring	Incoming emergency speech call
Call alerted	Called party is ringing
Busy tone	Called party is busy
Call queued	Call request is queued
Call diversion	Call is diverted to another user/service
Incoming data	Incoming data call
Alarm tone	Self-test failure
Battery low	Battery almost discharged
	(Audible and visual indications presented to the user when battery voltage falls below a security threshold)
Success tone	Acknowledgement of a user entry
Failure tone	Invalid user entry
Unprotected transmission	User has selected encrypted mode, but conversation is in clear mode.