

TSR2000 UHF transportable radio repeater

Official

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TSR2000 UHF Transportable Radio Repeater



1 Description

- 1.1 The TSR2000 UHF repeater is a self contained, transportable radio repeater, fitted inside a yellow ruggedised splash-proof box. This equipment enables full radio frequency communications to be established in locations where radio signal penetration is severely limited or not usually possible due to construction or location (e.g., large basements, sub-basements, ship holds, etc). It is programmed with LFB UHF radio channels 2, 5, and 8.
- 1.2 The repeater does **not** meet current European standards for intrinsic safety and therefore is **not** to be used in explosive atmospheres.
- 1.3 It is possible to use the TSR2000 in both surface and sub-surface environments as a stand-alone unit, or connected to other TSR2000 repeaters in series mode with the supplied link cable.
- 1.4 When connected together in series mode, the TSR2000 UHF repeater can provide analogue radio coverage over a distance of 1275 metres.
- 1.5 The TSR2000 is powered by an internal rechargeable battery, providing up to 5 hours of continuous use. The repeater can also be plugged into a standard 240V mains supply and should be connected to the charger within the allocated stowage until required for use. The TSR2000 UHF repeater unit weighs approximately 14.5kg; the link cable and cable drum weighs approximately 18kg.
- 1.6 There are a total of seventeen TSR2000 UHF transportable repeaters available for use at incidents to enhance analogue radio communications. One TSR2000 is carried on each of the Brigade's Command Units, with remaining units provided by the duty radio engineer on request.
- 1.7 The equipment is comprised of:
 - 1 x TSR2000 UHF transportable repeater;
 - 1 x 75m link cable drum with 2 male connectors;
 - 1 x link cable back-to-back extension adaptor with 2 female connectors;and can also be used in conjunction with
 - 1 x 200m small cable leaky feeder (carried on Command Units).

2 Operational considerations

- 2.1 The incident commander (IC) is to carry out a full dynamic risk assessment before deployment of the TSR2000. In particular, the IC should consider that:
- If an explosive atmosphere is known or suspected, then the TSR2000 UHF transportable repeater **must not** be deployed as it is **not** intrinsically safe.
 - Command Units only carry one repeater, one link cable drum (75m) and a (200m) leaky feeder cable drum. If additional repeaters are needed to cover a greater distance then the IC will need to contact the logistics manager at RMC and request the attendance of the duty radio officer with additional repeaters, link cables and back to back adapters.
 - A single repeater unit can be rapidly deployed by one BA crew; however, if the repeater is to be used in series mode then a number of crews may be necessary as the correct deployment is labour intensive and may take some considerable time.
 - If an incident is protracted, consideration must be given to monitor the battery charge levels and plans for the replacement with fully charged repeaters.
 - Maximum deployment distances are dependant on the number of repeaters and link cables available. Breathing Apparatus turn around times will also affect the distance of deployment.
 - A dedicated communication officer should be nominated to brief/debrief the crews deploying the TSR2000 equipment.
 - The repeater should not be used in premises where a working LFB fixed radio channel installation is in operation (e.g. LUL stations, Heathrow airport, Wembley stadium), as the two systems will cause radio interference with each other.
- 2.2 If necessary, the IC should contact the duty radio engineer for advice regarding the deployment of the TSR2000 UHF transportable radio repeater.

3 Deployment of equipment

- 3.1 The TSR2000 can be deployed in two ways:

- series mode;
- stand-alone mode.

The methods of deployment are described below.

Series mode

- 3.2 When deployed in series mode, the repeaters are inter-connected by link cables; these are stowed on cable drums. It is important to note that the link cables **do not** provide a power supply for the repeaters but are used to extend coverage and synchronise the repeaters.
- 3.3 The first repeater in the series is carried into position; this would normally be next to the BA entry control point.
- 3.4 The repeater is turned on and set to the desired UHF incident ground radio channel (Ch2, Ch5 or Ch8, depending on intended use). The talk-through setting is switched to '**On**' and the volume control should be set to **minimum** as the inbuilt speaker will not be required.
- 3.5 Attach the antenna to the Threaded Nexus Connector (TNC); close and lock the lid of the unit using the two metal locking hinges.
- 3.6 Before the link cable drum is carried into any incident hazard zone it is important that the brass drum brake screw is released (see Figure 1).

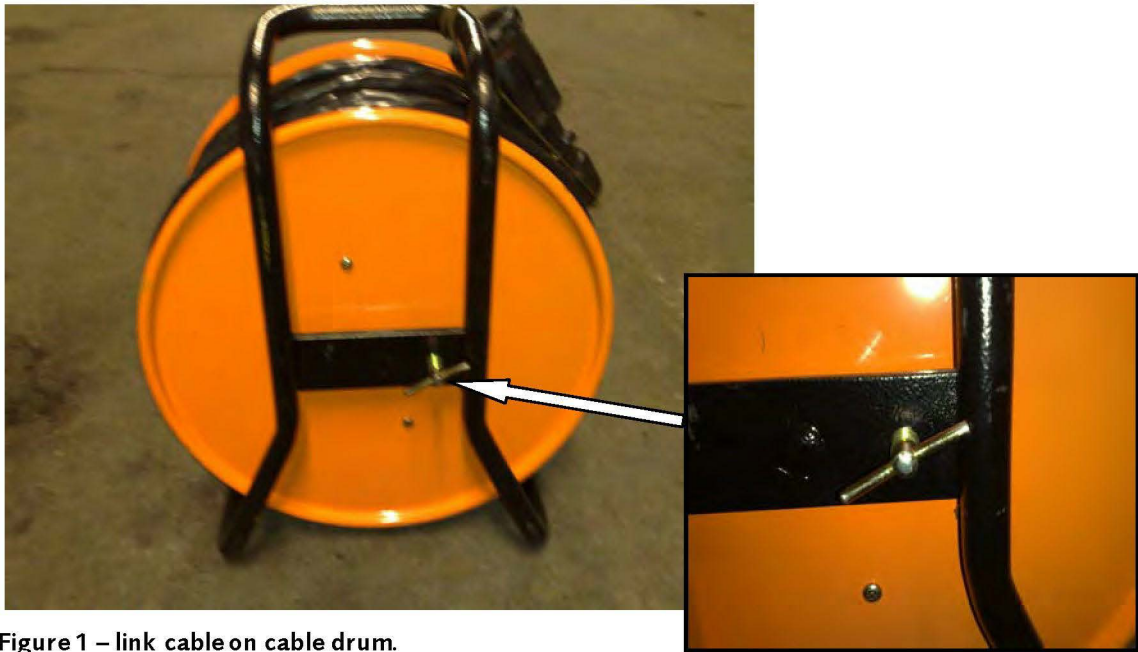


Figure 1 – link cable on cable drum.

- 3.7 Attach the **running end** of the link cable (male connector) to any one of three female cable connections on the repeater body. The shorter **standing end** of the link cable is housed in the silver clip on the side of the drum. As the drum is carried into the incident the cable should naturally unwind as progress is made.

[**Note** – although it is possible to connect the link cable in the opposite way with the **standing end** fitted to the one of the line connections on the repeater body, this should be avoided as it will result in the shorter standing end of the cable becoming twisted and damaged.]

- 3.8 Frequent radio checks must be carried out by the crew deploying the radio repeater and link cable. At the point where the radio signal starts to become weak, the link cable drum is to be placed in a position where it causes minimum obstruction to the access/egress of crews. An additional TSR2000 repeater can then be connected to the link cable plug; the drum brake screw (Figure 1) must be tightened to ensure that excess cable is not accidentally pulled from the drum.
- 3.9 Any additional repeaters used must be set to the same UHF radio channel as the initial TSR2000 repeater, with the talk-through switch set to 'on', volume set to minimum, antenna fitted to the TNC. The additional repeater must be switched off using the toggle switch and the unit lid closed and locked. Once the repeater has been positioned by BA crews and the link cable connected, the repeater can be turned on using the toggle switch and the lid closed and locked. Further link cables can then be deployed to connect repeater units and to give additional radio coverage as needed.
- 3.10 It is possible to continue connecting multiple TSR2000 UHF transportable repeaters and link cables in series mode up to a distance of 1275 metres. When sufficient radio coverage has been achieved through deployment of the repeaters and link cables, a TSR2000 repeater should be connected at the end point.
- 3.11 When deploying the link cable, if the end of the cable has been reached but the radio signal is still good, an additional cable can be connected using the back-to-back connector supplied within the equipment.
- 3.12 The following diagram (figure 2) shows an example of series mode deployment of the TSR2000, where the BA entry control officer can communicate with crews dealing with an incident in a sub basement on UHF Channel 5; in this example, the incident command channel is Channel 1.

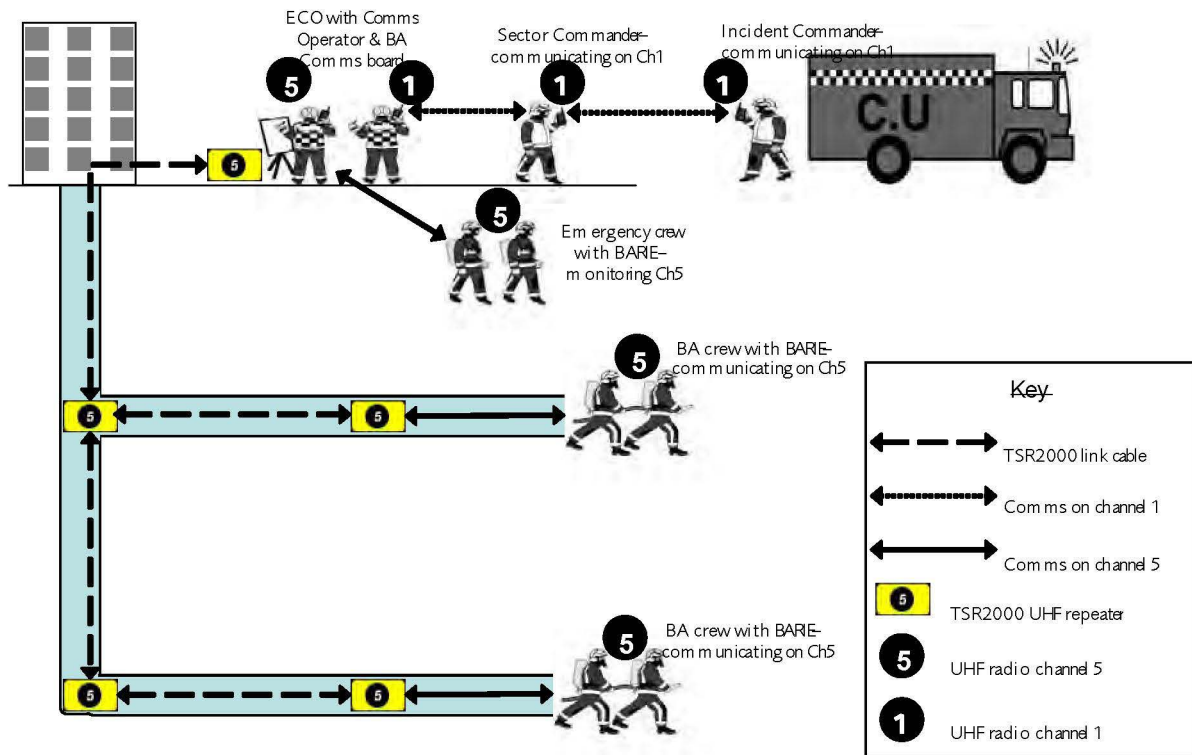


Figure 2 –TSR2000 deployed in series mode.

- 3.13 The coverage area for each TSR2000 repeater must not overlap, as this will cause interference between repeaters. This is achieved by ensuring that the TSR2000 repeater is only placed **after** the hand-held radio signal starts to weaken (as described in 3.8 above).
- 3.14 When sufficient coverage has been achieved for the incident, the deployment should end with a TSR2000 repeater suitably placed to provide communications coverage at the scene of operations.
- 3.15 Figure 3 below shows a standard series mode configuration using three TSR2000 UHF repeaters connected with two link cables.



Figure 3 – TSR2000 connected in series mode

- 3.16 It is possible to build a complex radio communications network with the TSR2000 UHF transportable repeater, as each unit is capable of having up to three link cables connected to it. These can be laid

out in three separate directions, with additional repeaters subsequently being deployed should they be required at an incident.

Stand-alone mode

- 3.17 In stand-alone mode, TSR2000 UHF transportable repeaters are not linked together using the supplied link cables. A single repeater is deployed in stand-alone mode to achieve signal coverage at an incident, and this can be monitored by a radio operator or positioned remotely and left unattended.
- 3.18 The repeater is turned on, and set to the desired UHF incident ground radio channel. The aerial should be connected to the Threaded Nexus Connector (TNC), and the talk-through switch set to 'On'.
- 3.19 When used in stand-alone mode, the repeater can be operated by using the integral fist microphone to transmit; the internal speaker can be used to listen to radio traffic and the speaker volume adjusted to the desired level. The repeater lid should be left open in order to access the microphone and speaker volume control.
- 3.20 If the intention is to leave a TSR2000 repeater unattended at an incident, then the speaker volume should be set to **minimum** and the lid should be closed and locked shut.

[**Note** – when more than one TSR2000 UHF repeaters are needed at an incident, they should be deployed in series mode.]

4 Operating instructions

- 4.1 The TSR2000 UHF transportable repeater is switched on or off using the toggle switch mounted on the inside of the lid.
- 4.2 When the repeater unit is fully charged and switched on, the power level LED on the top of the lid will appear green. If the power level LED appears yellow, this indicates a low battery level and the repeater unit will require charging.
- 4.3 The Control Head, which is mounted inside the lid, displays the currently selected radio channel (see Figure 4)

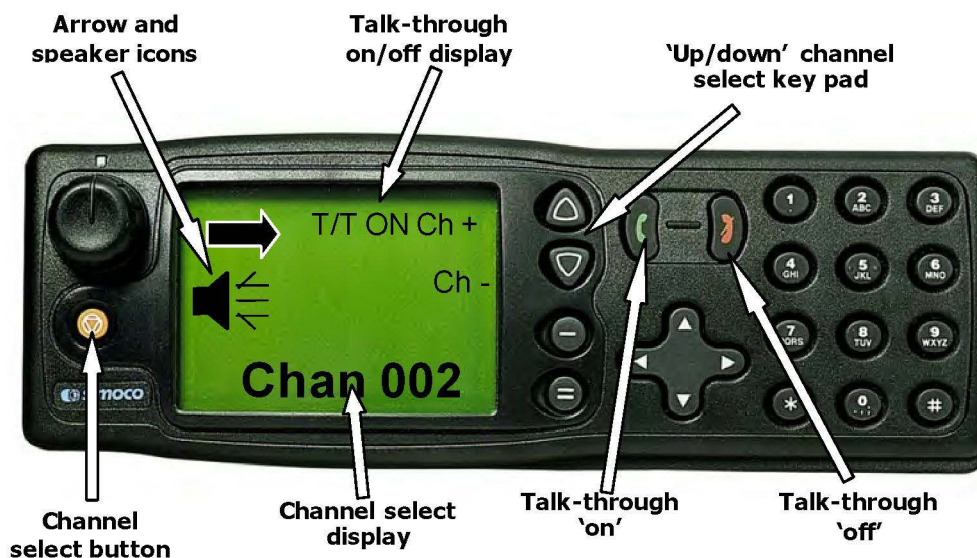


Figure 4 – TSR2000 UHF transportable repeater Control Head



- 4.4 Use the '**Up/Down channel select key pad**' to select the desired radio channel (Ch2, Ch5 or Ch8); alternatively press the orange '**Channel select button**' to the left of the control head screen to scroll to the desired channel (see Figure 4).
- 4.5 Ensure the talk-through setting is switched on by pressing the green '**talk-through on**' key to the right of the control head screen. When talk-through is correctly selected, the display will indicate "T/T ON" (see Figure 4).
- [**Note** – the numerical key pad, four way selector, "-" and "=" keys, and rotating knob have been disabled on the Control Head (although the upwards selector on the four-way selector has been enabled for transmission tests.)]
- 4.6 With talk-through switched on, the control head display will show an arrow () and speaker icon () when the unit is receiving a valid signal from an incident ground radio and is retransmitting the signal to other radios operating on the same channel. If the unit has been deployed in stand-alone mode with the internal speaker volume turned up then any radio traffic received will be audible on the unit's internal speaker.
- 4.7 The red "Tx" LED mounted on the outside of the TSR2000 lid (see Figure 5) will be illuminated when the unit is receiving and transmitting a radio signal with talk-through switched on.



Figure 5 – Tx and Power LED

- 4.8 When used in series mode, the repeater lid must be closed and locked with the lockable hinges before the repeater is deployed.
- [**Note** – although the TSR2000 can operate in stand-alone mode with talk-through switched off, there is no benefit to incident ground communications when operating in this way as the unit will work in the same way as any other portable incident ground radio. If incorrectly set with talk-through "off" the Tx LED will not be illuminated, and the control head display will not show an arrow icon; the speaker icon continue to be displayed.]

Connecting link cables (series mode)

- 4.9 The TSR200 UHF transportable repeater is fitted with 3 female link cable connectors on the left-hand side of the unit; these connectors are used to connect the supplied link cables to the TSR2000 when used in series mode. Any single link cable connector can also be used to charge the internal battery when the unit is connected to the supplied mains-supply charging unit within the Command Unit.(see Figure 6)



Figure 6 – female power-cable connectors

4.10 The male link line cable connector (on the link cable drum) is connected to the female line connection on the repeater unit as follows:

- Remove the screw fit blank cap from any one of the 3 female line connections on the repeater case, ensure that the red "O" ring washer is fitted and in good condition.
- Remove the screw fit blank cap from the male line connector on the cable drum. Check that the 14 pin connection is in good condition.
- Line up the larger lugs of the female (repeater end) with the male (cable end) and gently push into place. Care should be taken not to damage the pins.
- Hand-tighten the connections by rotating the collar on the male connector in a clockwise direction (see Figure 7, below).

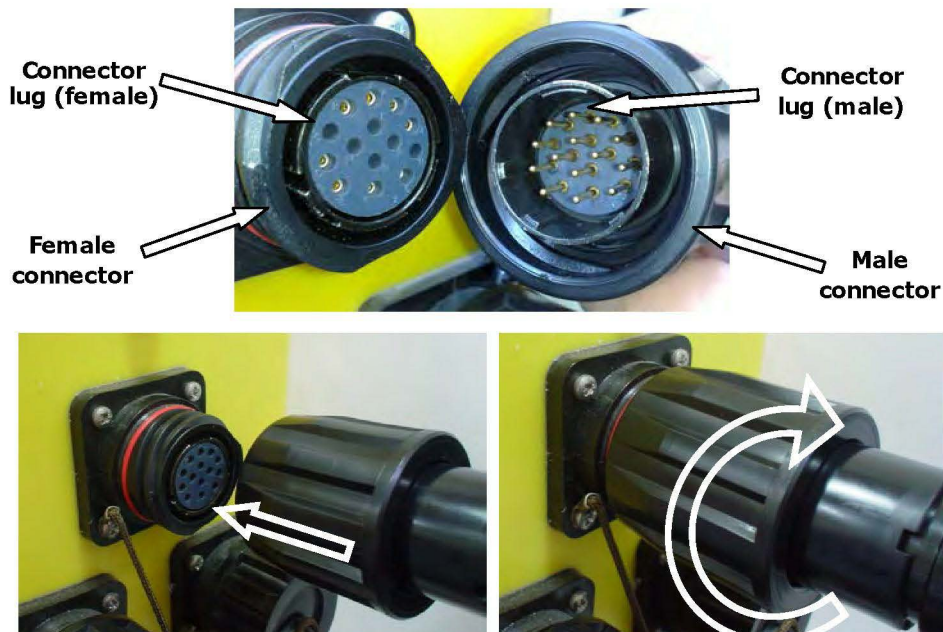


Figure 7 – connecting male and female link cable connectors

4.11 Disconnection of link cable connectors is reverse of the instructions above. Care should be taken to ensure the pins on the male connector are not damaged. It is important to remember to replace the blank caps on each of the connectors to prevent possible damage or the accumulation of dirt on the connectors.

Connecting the antenna

4.12 The repeater is fitted with a TNC coaxial connector, located on the outside of the lid. A blank cap is fitted to the connector to prevent damage and ingress of grease or dirt; the blank cap must be removed before an antenna can be fitted.

- 4.13 A ¼ wave whip antenna is supplied with the unit, and is secured to the inside of the box during transportation and storage.
- 4.14 An antenna must be connected before the TSR2000 repeater is deployed. If the supplied whip antenna is to be used, then it should be removed from the inside of the unit and screwed into place on the TNC fitting (see Figure 8).



Figure 8 – Threaded Nexus Connector (TNC) and whip aerial

Use of leaky feeder cable

- 4.15 A leaky feeder is a deployable aerial in cable form, which emits and receives radio signals along its length. A 200m leaky feeder cable, fitted to a cable drum, is carried on all command units.
- 4.16 The standard whip antenna supplied with the TSR2000 UHF transportable repeater can be replaced by a leaky feeder cable if necessary (see Figure 9). This may be beneficial when entering locations where deployment of additional TSR2000 repeaters is impractical or not necessary, or where poor signal penetration has been experienced due to building design. One practical application for the use of leaky feeder is to extend the effective range of the final TSR2000 repeater, when deployed in series mode.
- 4.17 Leaky feeder cable can be used with the TSR2000 repeaters when they are deployed in either stand-alone or series mode.

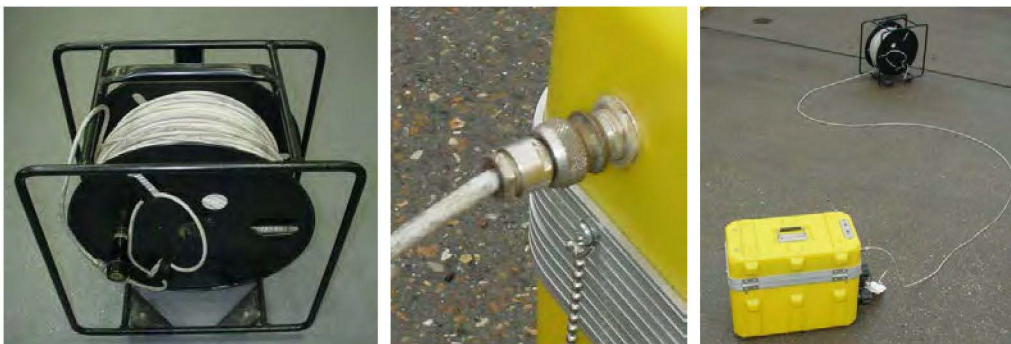


Figure 9 – leaky feeder cable used with TSR2000 repeater

5 Use of incident ground radios with TSR2000 repeater

- 5.1 There is no change to the way in which incident ground radios operate when the TSR2000 UHF transportable repeater is deployed at an incident. The guidance contained within [Policy number 488](#) - Incident communications should continue to be followed.
- 5.2 The TSR2000 repeater will enable effective radio communications on hand-held UHF channels 2, 5, and 8 only. No advantage is achieved in deploying this equipment when channels 2, 5, or 8 are not going to be in use.

- 5.3 If the TSR2000 has been deployed to provide radio coverage on UHF channels 2, 5, or 8, the transmission LED on the top of the unit will illuminate red when a radio signal is received and retransmitted.

Examples of TSR2000 deployment

- 5.4 The following examples are ways in which the TSR2000 UHF transportable repeater may be used to enhance radio communications at an operational incident:
- As a single unit deployed unattended in stand-alone mode, and secured in the cage of an aerial appliance.
 - This will provide radio coverage over a wide geographical area with a single repeater unit.
 - As fall-back for a defective repeater in a Command Unit (CU).
 - A single TSR2000 can be deployed in stand-alone mode; this can be unattended, as in the previous example, or attended by the CU radio operator, in which case the lid would be raised.
 - As fall-back in LUL or other premises with a fixed LFB channel 5 system.
 - The TSR2000 can be deployed in series mode throughout the anticipated area of operations. A leaky feeder attached to the last repeater unit would also help to extend radio coverage.
 - In confined spaces or collapsed structures (e.g., a USAR environment).
 - The nature of this type of incident would probably preclude the deployment of the TSR2000 repeater in series mode (due to restricted access). A single repeater unit could be deployed in stand-alone mode, with a leaky feeder cable connected in place of the standard whip aerial. The leaky feeder can then be laid within the confined space along the access route.

6 Charging

- 6.1 The TSR2000 UHF transportable repeater should be connected to the charging unit and kept fully charged and ready for use. Each command unit has been issued with a battery charger, which is plugged in to a dedicated 240V supply; when not in use the TSR2000 should be permanently connected to the battery charger. Additional charging units are held at radio workshops. When charging, the internal battery of the TSR2000 repeater has a red charging light which will be illuminated (see Figure 10).



Figure 10 – charging unit and TSR2000 internal battery

- 6.2 The male connector of the charging unit is fitted to any of the three link cable connectors on the side of the TSR2000 repeater.
- 6.3 Charging time for a fully discharged unit is between 10 to 12 hours. When fully charged, the power LED on the lid of the TSR2000 will be illuminated green (see Figure 5). Due to its construction, the battery does not require a monthly discharge process.

- 6.4 When used in series mode, the first TSR2000 repeater can be connected to a charging unit. This will provide unlimited power to the first repeater **only**. TSR2000 repeaters connected in series mode to the initial unit will be powered by their internal battery **only**.

[**Note** – this option should be considered when the TSR2000 repeaters are deployed at an incident which is likely to be protracted and a method of rotation and recharging of additional repeaters will need to be planned.]

7 Link cable extension

- 7.1 The link cable supplied with the TSR2000 UHF transportable repeater can be extended by use of a back-to-back female adapter. Connection is made in the same way as the link cable connection to the female connector on the TSR2000 unit, described above in section 4.10 (see Figures 7 and 11).



Figure 11 – back to back adapter

8 Safety and care

- 8.1 The TSR200 UHF transportable repeater **does not** meet current European standards for intrinsic safety and therefore must **not** be used in explosive atmospheres. Incident commanders must carry out a dynamic risk assessment (DRA) prior to committing any crew with this equipment. The DRA will need to take account of the following:

- If a naked flame is present, then any possibility of the repeater presenting an ignition source is irrelevant.
- The repeater may be used with breathing apparatus in compartments where a survey has been carried out using appropriate detection equipment.
- The DRA will need to be reviewed at regular intervals during the incident to ensure its currency.
- In cases of any doubt, the incident commander is to ensure that the TSR2000 repeater is not deployed and only intrinsically safe equipment is used.

- 8.2 The TSR2000 repeater weighs approximately 14.5Kg; a fully stowed link cable and cable drums weighs 18Kg. This should be considered when the equipment is being deployed.
- 8.3 With the lid closed and locked shut, the TSR2000 repeater is splash proof, and can withstand conditions that are normally encountered at operational incidents; the repeater unit cannot be immersed in water.

9 Maintenance and testing

- 9.1 The TSR2000 repeater is a robust unit which requires minimal maintenance and testing. The following actions should be carried out to ensure that the repeater is ready for operational deployment:
- When not in use, the repeater is to be connected to a charging unit.
 - Battery levels should be checked on a daily basis by switching on the repeater and checking that the power LED illuminates with a green light.
- 9.2 The inside of the TSR2000 repeater can be cleaned with a damp cloth; a mild-soap solution can be used to remove any dirt from the outside of the ruggedized plastic case.

10 Repairs

- 10.1 If a TSR2000 UHF transportable repeater becomes defective or damaged, radio workshops are to be contacted on extension 38561/2/3, detailing the serial number, location and nature of fault or damage.
- 10.2 A damaged repeater should be accompanied with a report detailing the circumstances of the damage and how it occurred.
- 10.3 A defective or damaged TSR2000 repeater is to be sent to radio workshops with an accompanying Form 171 and any associated damage report.

11 Further reading

- 11.1 This policy should be read in conjunction with the following policies:
- [Policy number 466](#) - Respiratory protective equipment - breathing apparatus – operational procedures
 - [Policy number 467](#) - BA Sub-surface procedure.
 - [Policy number 488](#) - Incident communications.
 - [Policy number 516](#) – Radio and Savox interface equipment (BARIE) – training note.

Appendix 1 – Incident ground channel allocation

Incident Ground Channel	Use
1	General Incident and Command
2	Additional Command Channel
3	Used under direction of the OIC / Sector Commander for Firefighter communications during specific tasks
4	To be used only under direction of the Duty Radio Officer
5	Communications (including Breathing Apparatus) where leaky feeder or base station equipment is installed
6	Breathing Apparatus
7	Police Inter Agency (channel 69)
8	Communications (including Breathing Apparatus) where leaky feeder or base station equipment is installed in specific overground buildings.
10	CPS Mapping Channel
11	Heathrow Airport Fire Service Channel
Channels 2, 5 and 70 will only work when used in with a radio repeater (CU, LUL, TSR2000).	
Police interagency channels 69 and 70 (HH radio channels 7 and 8) are Police Controlled frequencies and may only be used with their permission.	

Document history

Assessments

An equality, sustainability or health, safety and welfare impact assessment and/or a risk assessment was last completed on:

EIA	23/02/2010	SDIA	23/02/2010	HSWIA		RA	13/05/2013
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Audit trail

Listed below is a brief audit trail, detailing amendments made to this policy/procedure.

Page/para nos.	Brief description of change	Date
Throughout	This policy has been protectively marked.	24/01/2012
Throughout	All references to power cable have been changed to link cable.	15/05/2013
Page 1 & 14	The 'Protect' mark on this policy has been changed to 'Official' to bring us in line with the Government classification scheme.	20/03/2014
Page 16	'Subjects list' table - template updated.	06/01/2015
Page 13	Appendix 1, Channel 8 section updated. Reviewed as current.	15/07/2016

Subject list

You can find this policy under the following subjects.

Comms	TSR2000 UHF Transportable radio repeater
Assets	Equipment
Incident Management	Incident Command
TSR	Repeater
Radios	Leaky feeder
Incident Communications	Communication and messages
Communications	

Freedom of Information Act exemptions

This policy/procedure has been securely marked due to:

Considered by: (responsible work team)	FOIA exemption	Security marking classification
Jim A'Court – Incident Communications	Selected information to be redacted.	Official