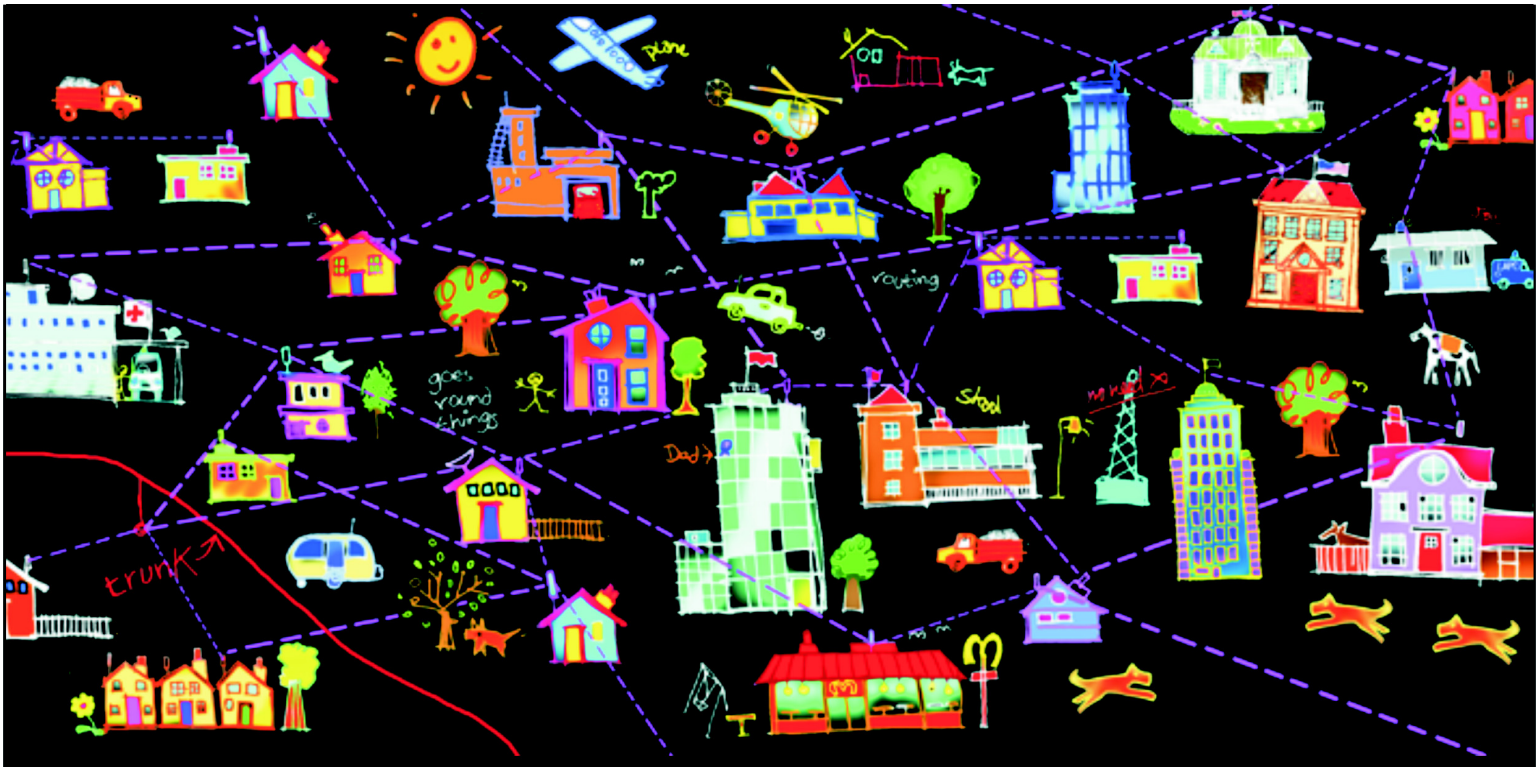

MESHWORKS™ Safety

Draft copy

Radiant™ Networks

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Draft status notice

This is a draft document circulated internally for review and comment.

This manual has been prepared for use by Radiant Networks personnel, licensees and customers.

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Contents

Introduction

This document draws attention to the hazards and risks involved when handling, installing and commissioning MESHWORKS Broadband Wireless Access telecommunications and electrical equipment.

Regular reference to this document is recommended to ensure that employees and contractors remain familiar with the identified hazards, risks and detailed general precautions. This document however, is not a substitute for the adoption of safe working systems, adequate training, competency and supervision (required by legislation, or organisations employing personnel to carry out the activities concerned).

It is essential that any personnel working directly on MESHWORKS equipment fulfil the following criteria:

- They should be competent, adequately trained and qualified to carry out the tasks required.
- They should be authorised to carry out the tasks required.
- They should be fully conversant with, and follow the specific safety guidelines relating to MESHWORKS equipment and the general safety procedures and safe systems of work of their company.
- They should always read and follow the warnings and cautions before starting work on any equipment.

MESHWORKS documents provide written procedures, which state the precautions to be taken to ensure health and safety during the installation and commissioning of MESHWORKS equipment. At appropriate places in the documentation, safety procedures, warning and caution notices are detailed relating to specific activities to alert employees and contractors to potentially hazardous situations.

Documentation also draws attention to the requirement for those installing and commissioning MESHWORKS equipment to refer to safety procedures and safe systems of work, established by their own companies.

You must always read and follow the warnings and cautions before starting work on any equipment.

General safety notes

Warnings and cautions

Warnings

In MESHWORKS documentation, warning notices are provided to alert you to potentially hazardous situations, which may arise if the proper precautions are ignored. Warnings of this type are used throughout the Meshworks documentation.

Warning notices look like the following examples:

***Risk of personal injury**:*
A warning with this symbol indicates a risk of personal injury.

Other warning notices will use specific symbols as shown in the examples below:

***Risk of electric shock**:*
A warning with this symbol indicates a risk of personal injury due to an electrical hazard.

***Risk of laser radiation**:*
A warning with this symbol indicates a risk of personal injury due to laser radiation.

Cautions

In MESHWORKS documentation, caution notices are provided to alert you to situations where damage to equipment, or, interruption of service may occur if the proper precautions are ignored. Always read the caution notices before starting work on any equipment. Caution notices look like these examples:

Risk of service interruption:
A caution with this symbol indicates that there is a risk of service interruption or equipment damage.

***Risk of electrostatic discharge**:*
A caution with this symbol alerts you to use electrostatic discharge protection to avoid damaging equipment.

Labels on Mesh components

Some Mesh components, such as ODUs, carry labels with caution and warning symbols. These may look like the following examples:

***Risk of non-ionising RF radiation**:*
A caution with this symbol informs you of a safe distance of approach to an ODU.

Safety standards

Standards

Many national and international standards deal with the safety aspects of electrical and electronic products. These standards aim to ensure that products are designed, manufactured and tested to eliminate hazards, so that users get equipment that can be installed and used with complete safety. MESHWORKS equipment is designed to confirm to all the relevant safety standards. In particular, it complies with the following:

- BS EN 60950 2000, Safety of information technology equipment, including electrical business equipment.
- BS EN 41003, Particular safety requirements for equipment to be connected to telecommunications networks.
- BS 7671 1992 Requirements for Electrical Installations. IEE Wiring Regulations (Sixteenth edition).
- BS EN-1:1994 ‘Safety of Laser Products: Part 1. Equipment classification, requirements and user’s guide’.

Attention has also been given to the following:

- 1999/519/EC. Harmonised standards covering protection from electromagnetic fields (0 Hz to 300 GHz) generated by apparatus included in the scope of either the Low Voltage Directive (LVD) 73/23/EEC, or the Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive.
- Documents of the National Radiological Protection Board (NRPB) Vol. 4, No.5 1993, ‘Restrictions on Human Exposure to Static and Time-Varying Electromagnetic Fields and Radiation.’
- Board Statement of the National Radiological Protection Board (NRPB) Vol. 4, No.1 1993. 1990 Recommendations of the International Commission on Radiological Protection (ICRP).
- The Management of Health and Safety of Work Regulations 1992.
- The Health and Safety at Work etc. Act 1974, (section 6, as amended by the Consumer Protection Act 1987).
- The Health and Safety (Safety Signs and Signals) Regulations 1996.
- Control of Substances Hazardous to Health Regulations 1994.
- Environmental Protection Act 1990 (Recycling of packaging).

Optical safety

Working with lasers

The optical interface module (OC-3/STM-1, Multimode Transceiver) on the MESHWORKS Outdoor Unit contains a surface emitting LED. The LED emission level does not exceed the Accessible Emission Limit of a Class 1 laser/LED under all conditions of operation, maintenance, service and failure.

Risk of laser radiation:
Do not look into the optical interface module at any time.

Working with optical fibre cables

When working with optical fibre, you must take precautions to avoid personal injury and damage to equipment:

Precautions against risk of injury

You must take the following precautions in order to avoid risk of injury:

- Always ensure that all employees and contractors are trained adequately in the measures appropriate to the EN 60825 classification.
- During installation, always position optical cables in a secure and safe place.
- When installing optical fibres, always wear safety glasses.
- Small bits of glass can be almost invisible. After handling optical cables always wash or wipe hands clean before making any contact with eyes.
- To pick up and discard any loose fibre ends, use tweezers or the sticky side of a piece of adhesive tape. **Do not handle pieces of cut fibre with bare fingers**.
- Place all fibre cuttings in a suitable container.

- Never view an unterminated optical fibre, connector, or broken fibre unless the optical source has been turned off.
- Verify that warning labels are at all times clearly visible.

Precautions against damage to equipment

You must take the following precautions to avoid damage to fibres or associated equipment or loss of data:

- Always handle optical fibres carefully.
- Take care not to exceed the minimum bend radius (typically 35 mm) when dressing fibres.
- Do not over tighten cable ties for dressing fibres.
- Ensure that the optical fibres are not trapped by the protective cover on the unit before sliding the unit in position when connecting connectors.
- Do not rotate the optical plug unnecessarily when making a connection.
- Before making any optical connection, clean all optical plugs and coupling by an approved method.
- To avoid contamination by dust, or leakage of stray radiation, protect optical connectors with dust caps whenever possible.

Handling & transport

Manual handling

Good handling technique

In order to prevent potential musculoskeletal injury, employees should be aware of and trained in manual handling techniques. MESHWORKS documentation contains warning notices to alert readers of situations where manual handling is required and indicates where two employees will be required to facilitate a safe manual handling activity. Tips on good handling technique follow below:

Assess the situation

Plan the lift. Assess whether it is appropriate to use mechanical lifting aids or help from others. For a long lift, such as floor to shoulder height, consider resting the load mid way to change the grip. Make sure you are wearing appropriate clothing and footwear

Position your feet

Placing your feet apart will give you a balanced and stable base for lifting. Try to put the leading leg as far forward as possible in the direction you want to go.

Adopt a good posture

When lifting from a low level, ensure that you bend the knees. However, do not kneel or overflex your knees. Try to keep your back as straight as possible, maintaining its natural curve. Tucking your chin close to your chest will help with this. Lean forward over the load if necessary to get a good grip. Try to keep your shoulders level and facing the same direction as your hips.

Get a firm grip

The best position and type of grip depends on personal preference and circumstances. However, a hooked grip is less tiring than using straight fingers. If you need to vary the grip over the time of the lift, do it as smoothly as possible.

Keep close to the load

Keep the load as close to the trunk of the body as possible. If a close approach to the load is not possible, slide it towards you before you lift.

Jerk-free movements

Lift the load smoothly, raising your chin as the lift progresses, keeping control of the load.

Move your feet

Move your feet when carrying a load - don't twist your body.

Put down, then adjust

If the load has to be positioned precisely, put it down first, then adjust it into the desired position.

Further reading

For more information, please refer to the following publications from the Health & Safety Executive:

Manual Handling: Solutions you can handle
HSG115 1994 HSE Books
ISBN 0 7176 0693 7

Manual Handling: Guidance on Regulations
L23 1998 HSE Books
ISBN 0 7176 2415 3

Getting to grips with Manual Handling
INDG143 (rev1) 7/00 HSE Leaflets
ISBN 0 7176 1754 8

These publications can be obtained from:

HSE Books,
PO Box 1999,
Sudbury,
Suffolk
CO10 2WA

Tel: 01787 881165

Website: `http://www.hsebooks.co.uk`

Environmental considerations

Packaging

MESHWORKS has sensitive equipment. For transportation and storage purposes, we try to minimise our use of packaging while conforming to legal requirements and product specifications. All MESHWORKS packaging material is biodegradable and can be recycled.

General environmental operating conditions

MESHWORKS equipment should be protected from the environmental conditions which fall outside of those shown below and in their associated documentation, for transportation, storage and operation of the equipment. During transport, condensation can occur within the equipment, especially when moving the equipment indoors. Ensure that all of the equipment has reached the ambient temperature and is dry before installation and operation. Radiant Networks continues to develop the MESHWORKS equipment to extend its ability to operate in more extreme environments. Consult Radiant Networks if there is a need for MESHWORKS to operate outside of the ranges specified below.

MESHWORKS equipment complies with EN 300 019 Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment.

MESHWORKS outdoor equipment

Equipment classed as *Outdoor* includes:

- All Outdoor Units (ODUs) for customer nodes, Seed Nodes, Mesh Insertion Points (MIPs) and Trunk Network Connection Points (TNCPs).
- Outdoor cables.
- Installation mechanics.

The outdoor equipment will operate normally within the following temperature and humidity ranges:

- Operating temperature: -33 ^{o}C to +45 ^{o}C.

Note that the European model of the ODU (marked 970200-01 on its label) is restricted to -20^{o}C to +45^{o}C for QPSK modulation and -20^{o}C to +35^{o}C for QAM modulation.

- Relative Humidity: 5-100%.
- Storage temperature: -33^{o}C to +60^{o}C.

MESHWORKS indoor equipment

Equipment classed as *Indoor* includes:

- The MESHWORKS Indoor Unit (IDU).
- The Radiant Edge Processor (REP).
- The Radiant Edge Switching System (RESS)
- The Mesh Element Manager (MEM).
- The Mesh Management and Planning Systems (MMS and MPS).
- Power supplies for Seeds and MIPs.
- Cables connecting two or more items of indoor equipment, with no outdoor run.

The indoor equipment will operate normally within the following temperature and humidity ranges:

- Operating temperature: 1^{o}C to +45 ^{o}C.
- Relative Humidity: 5%-90%.
- Storage temperature: -33^{o}C to +60^{o}C.

Safe environmental disposal

Each MESHWORKS ODU contains Gallium Arsenide Monolithic Microwave Integrated Circuits (GaAs MMICs).

When disposing of ODUs, please observe the following caution:

Caution: GaAs Products

The ODU module contains gallium arsenide (GaAs). GaAs vapour and powder are hazardous to human health if inhaled or ingested.

- **Do not** destroy or burn any part of the ODU.
- **Do not** cut or cleave off any part of the ODU.
- **Do not** crush or chemically dissolve any part of the ODU.
- **Do not** put any part of the ODU in your mouth.

Follow the appropriate related laws and ordinances for correct environmental disposal of the ODU.
Do not dispose of the ODU with general industrial or household waste.

Reference

Glossary of terms

Broadband Wireless Access

An access technology that allows a service provider to deliver high bandwidth content over the air to their customers. Typical definitions include radio technologies using spectrum from 2.1 GHz to 44 GHz.

Electromagnetic Field

An electromagnetic field, sometimes referred to as an EM field, is generated when charged particles, such as electrons, are accelerated. All electrically charged particles are surrounded by electric fields. Charged particles in motion produce magnetic fields. When the velocity of a charged particle changes, an EM field is produced.

Mesh Element Manager (MEM)

The Mesh Element Manager (MEM) is used to communicate with a segment of the Mesh. For resilience purposes, each segment can have more than one MEM. The MEM can be considered as a front-end processor to the MMS. It minimises the traffic requirement on the link between the MEM and the MMS.

Electro-Static Discharge

The rapid discharge of static electricity from one conductor to another of a different potential. An electrostatic discharge can damage integrated circuits found in computer and communications equipment.

Indoor Unit (IDU)

The MESHWORKS Indoor Unit (IDU) is used at nodes where customers require service. The IDU provides the Customer-end adaptation functions. It offers two main services, IP Services (Ethernet or USB) and Primary Rate Telephony Services (E1 or T1). The IDU connects to the OutDoor Unit using a standard ATM25 connection, and provides traffic policing and shaping into the Mesh and traffic shaping out of the Mesh.

Mesh Insertion Points (MIPs)

An operator node with a direct link to a TNCP to provide bandwidth to the Mesh. At the MIP two or more ODUs can be co-located and connected together, one configured as the end of the high-speed link to the TNCP and the other as a normal ODU with links to other ODUs in the Mesh.

Mesh Management System (MMS)

The Radiant Mesh Management System (MMS), although a separate tool from the Mesh Planning System (MPS), shares an interest in a great deal of data generated and used by the MPS. Apart from standard functions of fault, configuration, performance and security management, the MMS is also responsible for performing and controlling adaptations to the active Mesh. The MMS is able to survey potential links within the active Mesh, as well as testing and measuring the performance of the existing links of the active Mesh.

Mesh Planning System (MPS)

The Mesh Planning System comprises of a set of tools to allow the operator to plan, commission, operate and maintain a Mesh. The planning tool holds multiple prospective network models at any one time to allow the comparison of the properties of alternative Mesh layouts. Once a network has been designed, the planning tool supports the activities required for turning a scenario into physically deployed and operational equipment.

Outdoor Unit (ODU)

The Outdoor Unit or ODU is the main building block of the MESHWORKS system.The ODU is the high-volume Mesh radio, used at all the Mesh Nodes. It contains the millimetric radios, steerable antennas inside the radome, the baseband modem, embedded ATM switch and the host processor running the node and link management applications.

Optical Fibre

A technology that uses glass (or plastic) threads (fibres) to transmit data. A fibre optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages modulated into light waves.Fibre optics has several advantages over traditional metal communications lines. They have a much greater bandwidth than metal cables, which means that they can carry more data and are less susceptible than metal cables to interference. The cables are much thinner and lighter than metal wires. Data can be transmitted digitally (the natural form for computer data) rather than through analog means.

Radiant Edge Processor (REP)

The Radiant Edge Processor or REP, is part of the Radiant Edge Switching System (RESS). It provides the protection switching and edge-to-edge services across the Mesh and a commercial ATM switch.The REP itself can be considered to be a peer to part of the Indoor Unit (IDU) of the customer node. As well as protection switching, the REP provides the core end of the traffic management process for Mesh services.

Seed Nodes

Unless early customers have visibility of one or two MIPs, it will be necessary to add ‘Seed’ nodes to provide the necessary access to customer sites. They are positioned simply to provide additional coverage. The Seeds are normal Node ODUs. There is a requirement that Seeds have to possess a line of sight to at least one other MIP, TNCP or other Seed. The process of ‘Seeding’ a Mesh can be continued until a required level of initial customer reach is achieved.

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Index

Numerics

A

B

C

D

E

F

G

H

I

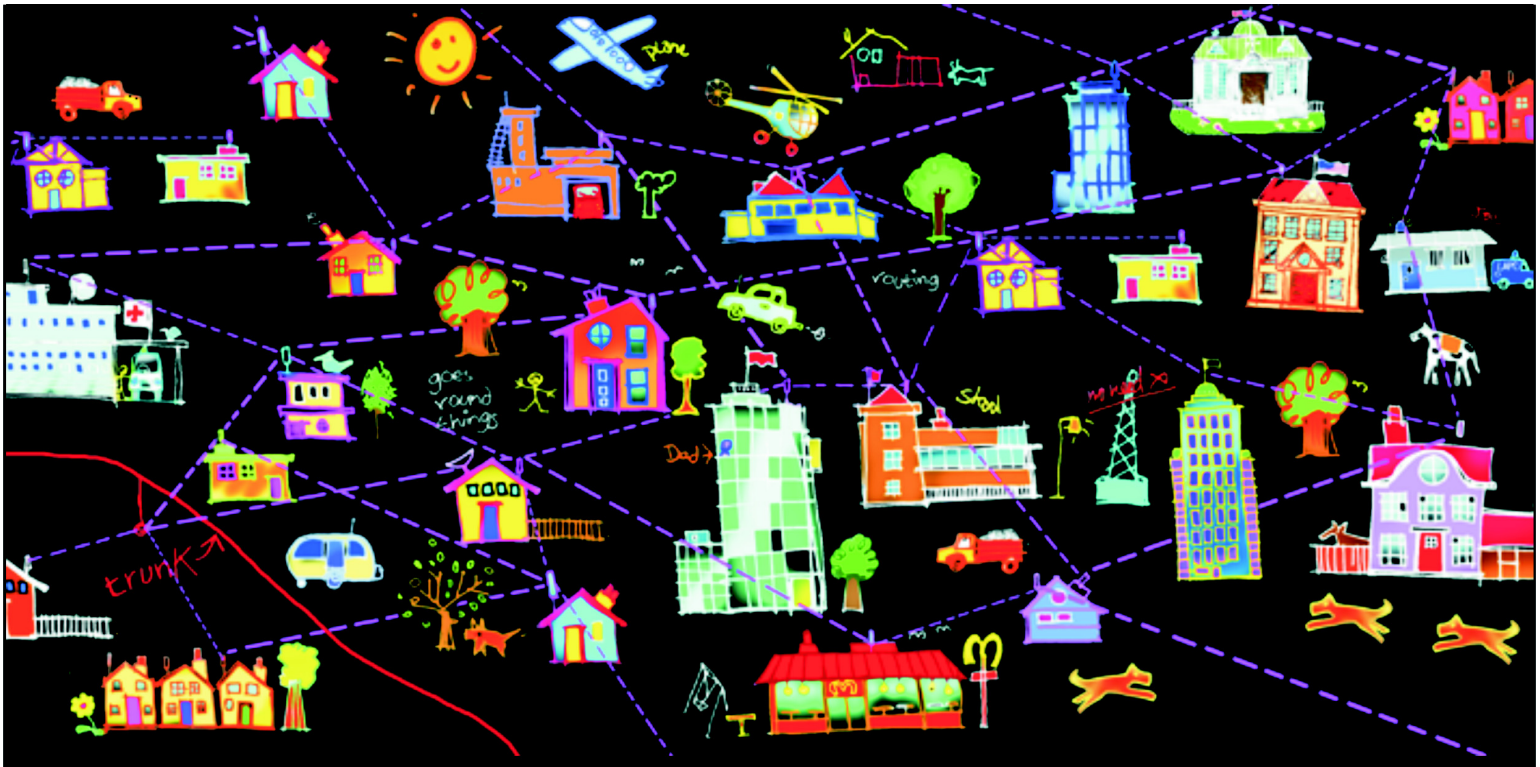
L

M

N

O

P



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