

Safe Work Practices on Radio Frequency Transmitting Apparatus

Summary:

This document supports the Power System Safety Rules and its requirements assembled under 'Radio Frequency Transmitting Apparatus' Category 8.

It covers safe work practices on Radio Frequency Transmitting Apparatus to maximise the safety of staff where it is possible for radio frequency electromagnetic radiation exposure levels to occur.

This standard applies to all persons working on Radio Transmitting Apparatus.

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When referring to TransGrid's policies, frameworks, procedures or work instructions, please use the latest version published on the intranet.

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1. Overview

1.1. Purpose

This document supports the Power System Safety Rules and its requirements assembled under 'Radio Frequency Transmitting Apparatus' Category 8.

1.2. Policy Base

Document No.	Document
GD SR G1 100	Power System Safety Rules

1.3. Reference Documents

Document No.	Document
Australian Communications and Media Authority	Human Exposure to Radiofrequency Electromagnetic Radiation Information for licensees of radio communications transmitters OCTOBER 2005
ARPNSA Radiation Protection Standard	Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz
GD HS G1 003	Electric & Magnetic Fields & Radio Frequency Electromagnetic Fields - Policy
GD SR G2 140	Operating Process for Access to LV & MECH Apparatus
GD SR G2 141	Access for Work on LV & MECH Apparatus
GD SR G2 142	Safe Work Practices on LV & MECH Apparatus

1.4. Scope

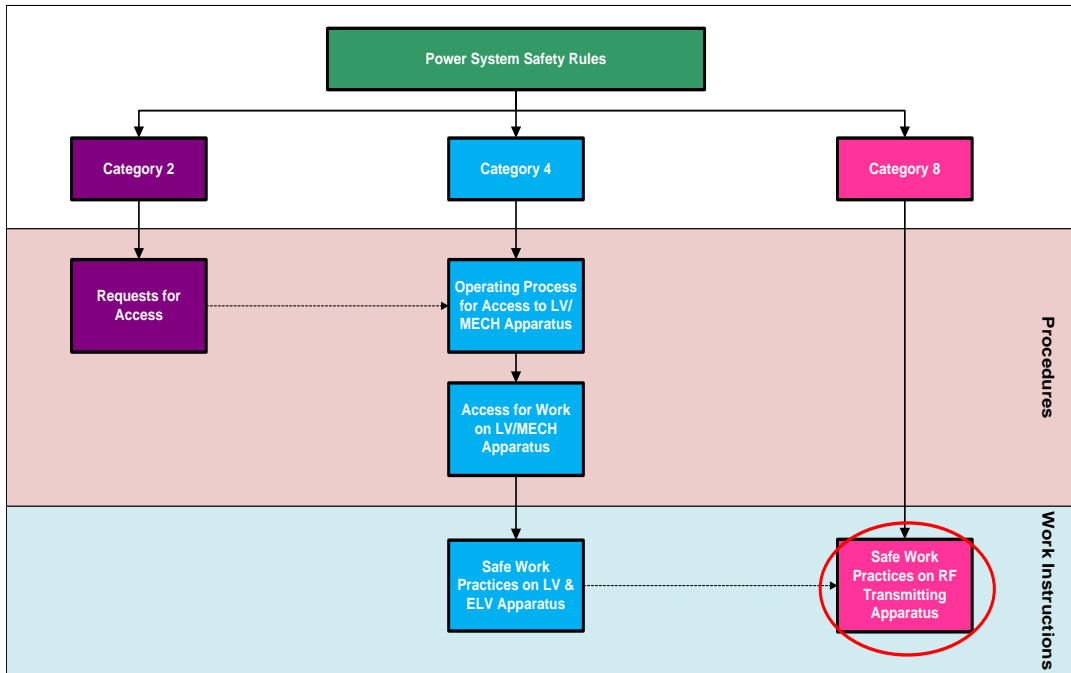
This standard covers safe work practices on Radio Frequency Transmitting Apparatus to maximise the safety of staff where it is possible for radio frequency electromagnetic radiation exposure levels to occur.

1.5. Role and Responsibilities

Responsible person	Responsibility
Manager/Health,Safety and Environment	Maintenance and ownership of this standard
Mgr. – Training	Implementation of training packages associated with this standard
Authorised persons	Comply with this standard

1.6. Document Location

Block diagram showing location of document in relation to others.



2. Introduction

This standard was developed to assist staff in selecting the correct safe work practices to be used when performing work on or near Radio Frequency Transmitting Apparatus. Work may only commence on or near Radio Frequency Transmitting Apparatus following the implementation of safeguards applicable to the work being undertaken.

The safe work practices contained within this document assist in the protection of staff when working on or around Radio Frequency Transmitting Apparatus. It sets out a range of hazardous situations, the controls (safeguards) to be implemented and describes the safe work practices which must be observed.

These safe work practices are to be used in conjunction with TransGrid's OHS Risk Assessment Process - GD SA G2 005. The process may identify that additional controls are required for particular tasks and situations.



3. Radio Frequency Electromagnetic Radiation

All Radio Frequency Transmitting Apparatus (RFTA) generate Radio Frequency (RF) Electromagnetic Radiation (EMR) as part of normal operation. The RF EMR can be described as waves of electric and magnetic energy emanating from a source in an outwards direction moving through the air. The source is usually the antennae associated with the RFTA. RF EMR is also found as part of everyday life, emitted by natural sources like the Sun, the Earth and the ionosphere.

RF EMR is also emitted by artificial sources such as electrical and electronic equipment, mobile phone base stations, broadcast towers and radar facilities. Sources of RF EMR can be either unintentional eg radiated into space from slots, gaps or structures such as leakage from the door of a microwave oven or intentional eg radiated from a telecommunications antenna.

4. Radio Frequency Electromagnetic Radiation Hazard

Exposure to sufficiently high levels of RF EMR can heat biological tissue and, consequently, potentially cause tissue damage due to the human body's inability to cope with the excessive heat generated.

Radio Frequency EMR exposure is based on Specific Absorption Rate (SAR) of the body. SAR is the amount of energy the body absorbs over a 24 hour period relative to the mass of the body averaged over six minute intervals. For occupational workers a safety factor of 10 fold has been incorporated into SAR values from the levels of the first know heating effect on the body.

$$\text{SAR} = \text{Total Power Absorbed in the Body} / \text{Total Mass of the Body}$$

Classification	Work Environment	SAR
<i>Occupational (RF Worker)</i>	<i>Restricted Access Zone (Yellow Zone)</i>	<i>0.4W/kg</i>
<i>Non Occupational</i>	<i>General Access (White Zone)</i>	<i>0.08W/kg</i>

Studies have shown that environmental levels (non-occupational) of RF EMR routinely encountered by the public are far below the levels needed to produce significant heating and increased body temperature.

5. Occupational Exposure Control Principles

The following are the TransGrid RF EMR hazard control principles;

- 1. The Primary Control Principle is to Minimise RF EMR exposure and restrict access to RF EMR hazard areas.** Where access is required to RF EMR hazard areas appropriate arrangements shall be made to switch off equipment causing elevated radiation levels.
- Access zones have been determined for all Radio Frequency Transmitting Antennae and are classified as Prohibited (Red) Access, Restricted (Yellow) Access and General (White) Access Zones. Access zones are described and recorded for each Radio Frequency Transmitting Antenna in a Site Management Book. These are described in Attachment A.
- No person is to enter the Prohibited (or Red) Access Zone associated with an active Radio Frequency Transmitting Antenna.
- Only Radio Frequency Workers may enter Restricted (Yellow) Access Zones when a Radio Frequency Transmitting Antenna is active. Allowable exposure levels shall not be exceeded.
- Not break the path between the Radio Frequency Transmitter and the Antenna associated with active Radio Frequency Transmitting Apparatus, unless it is a design condition of the apparatus or required for testing.
- Access restriction and RF EMR signage shall be implemented to notify of hazard and control access to Radio Frequency Transmitting Apparatus. These are described in Attachment A.

6. Safe Work Practices for Work on Radio Frequency Transmitting Apparatus

6.1. General

- (a) Work on Radio Frequency Transmitting Apparatus shall be in accordance with this procedure and carried out by a person authorised category 8 in the Power System Safety Rules or an instructed person.
- (b) All personnel who access a tower, pole or structure supporting Radio Frequency Transmitting Antennae shall consult the Site Management Book to determine any relevant Access Zone and sign the site log book.
- (c) If the Site Management Book is incomplete, not updated or not available use interim safe working procedures and contact your supervisor.
- (d) If safety cannot be maintained discontinue work and contact your supervisor.
- (e) Only TransGrid authorised Radio Frequency Workers may isolate in-service TransGrid Radio Frequency Transmitting Apparatus

6.2. Work on an Radio Frequency Transmitting Apparatus Required to be Isolated

6.2.1. Prior to Commencing Work

- (a) Consult the Site Management Book to determine the Prohibited and Radio frequency Worker Access Zones.
- (b) Make inactive and isolate identified Radio Frequency Transmitting Apparatus before accessing structure.

6.2.2. Requirements for Request For Access

- (a) For all work on a Radio Frequency Transmitting Apparatus which requires the Radio Frequency Transmitting Apparatus in the charge of a controller isolated a Request for Access shall be submitted in accordance with section 2 of the Power System Safety Rules with the required Radio Frequency Transmitting Apparatus described and with 'Verbal' specified in 'Access Required' column.
- (b) Radio Frequency Transmitting Apparatus in the charge of a controller includes Radio Frequency Transmitting Apparatus that supports services required for protection intertrips and supervisory control and monitoring equipment of any description (LCSS, SCADA, EMS etc).
- (c) Radio Frequency Transmitting Apparatus that is not in the charge of a controller is that apparatus which is not included in the preceding paragraph (b) and includes apparatus such as that required for telephony trunks and VHF/ UHF radio.

6.2.3. Isolation/Restoration and Access – RFTA in charge of a controller

- (a) The Radio Frequency Worker contacts the controller to advise of the planned removal from service of the Radio Frequency Transmitting Apparatus as described on the Request for Access.
- (b) The controller shall issue the Radio Frequency Worker with a verbal clearance to commence work.
- (c) The Radio Frequency Worker isolates the Radio Frequency Apparatus and attaches Do Not Operate tag(s) if no testing is required during work or attaches Warning Tag(s) if testing is required during work.
- (d) Prior to accessing the tower, pole or structure the Radio Frequency Worker shall consult the Site Management Book to determine any relevant Prohibited Access Zones and Radio Frequency Worker Access Zones and confirm the correct RFTA is now isolated.
- (e) If, during work, the Radio Frequency Transmitting Apparatus is required to be made active for testing purposes the Radio Frequency Worker shall ensure that all connections have been properly re-

instated and that all persons are clear of the Radio Frequency Transmitting Antenna and relevant access zones and that any plant, tools and materials have been removed unless required for the testing.

- (f) On completion of work the Radio Frequency Worker is to remove the Do Not Operate or Warning Tag(s) and restore to service the isolated Radio Frequency Transmitting Apparatus.
- (g) After restoration is complete the Radio Frequency Worker is to advise the controller that work is completed and that the Radio Frequency Transmitting Apparatus has been returned to service.

6.2.4. Isolation/Restoration and Access – RFTA not in charge of a controller

- a) The Radio Frequency Worker isolates the Radio Frequency Apparatus and attaches Do Not Operate tag(s) if no testing is required during work or attaches Warning Tag(s) if testing is required during work.
- b) Prior to accessing the tower, pole or structure the Radio Frequency Worker shall consult the Site Management Book to determine any relevant Prohibited Access Zones and Radio Frequency Worker Access Zones and confirm the correct RFTA is now isolated.
- c) If, during work, the Radio Frequency Transmitting Apparatus is required to be made active for testing purposes the Radio Frequency Worker shall ensure that all connections have been properly re-instated and that all persons are clear of the Radio Frequency Transmitting Antenna and relevant access zones and that any plant, tools and materials have been removed unless required for the testing.
- d) On completion of work the Radio Frequency Worker is to remove the Do Not Operate or Warning Tag(s) and restore to service the isolated Radio Frequency Transmitting Apparatus

6.3. Work on Active or Inactive Radio Frequency Transmitting Apparatus

6.3.1. Work on Active or Inactive Antenna

Where work requires access to an active or inactive Radio Frequency Transmitting Antenna the Radio Frequency Worker shall:

- a) Consult the Site Management Book to determine the Prohibited Access Zones and Radio Frequency Worker Access Zones;
- b) Identify the Radio Frequency Transmitting Antenna;
- c) Take suitable precautions such as having an observer in place and/or wearing a personal detector/monitor when entering Radio Frequency Worker Access Zones; and
- d) Use safe work methods relevant to the work.

6.3.2. Work on Active or Inactive Coax, Waveguide, Filter or Coupler

Authorised staff shall use safe work methods relevant to the work.

7. Radio Frequency Transmitting Apparatus Hazardous Situations

The following table lists situations that could be encountered when working on Radio Frequency Transmitting Apparatus and controls to be implemented.

Situation	Hazard	Control
Accessing Towers/Poles	Radio Frequency Personnel Injury	Consult Site Management Book Avoid entering prohibited or restricted access zones Use Personal Monitor/Detector if required
Work on a Radio Frequency Transmitting Antenna	Exposure to RF radiation Burns	Isolate Radio Frequency Transmitting Antenna Identifying isolated Radio Frequency Transmitting Antenna Identifying any active Radio Frequency Transmitting Antennae
Repairing/changing out a dehydrator or wave guide.	Compressed Gases(air) Injuries due to release of compressed gas	Isolate equipment before work Controlled release of pressure Use PPE (eye protection)
Electrical storage batteries	Electric shock Manual handling injuries Electrolyte burns	Electrical isolation and testing Mechanical aids, multiple persons PPE, gloves, face mask Eye wash available Ventilation

8. Radio Frequency Worker

8.1. General

Radio Frequency Workers are those staff approved by Manager/Technical Services to be TransGrid Radio Frequency Workers, are authorized under the PSSR for applying 'Do Not Operate' and 'Warning Tags' and who have been trained and are familiar with;

- (a) The responsibilities and accountabilities for RF EMR safety,
- (b) Safe work practices and the appropriate controls to manage the potential RF EMR hazard,
- (c) RF EMR hazard area signage and access restriction methods and,
- (d) The RF EMR hazard information contained in the Site Management Book and its use.

8.2. Responsibilities of TransGrid Radio Frequency Worker

All TransGrid Radio Frequency Workers shall:

- (a) Read and implement the requirements of entry point warning signs to RF EMR areas,
- (b) Be approved to make inactive and isolate TransGrid operational Radio Transmitting Apparatus
- (c) Follow the requirements of this procedure and any relevant work procedures,
- (d) Brief contractors and instructed persons prior to accessing a tower or pole containing Radio Frequency Transmitting Apparatus and ensure that all such persons read and sign the log in the Site Management Book,
- (e) Not enter the Prohibited Access (Red) Zones;
- (f) Not break the path between the Radio Frequency Transmitter and the Antenna associated with active Radio Frequency Transmitting Apparatus, unless it is a design condition of the apparatus or required for testing;
- (g) Not exceed allowable exposure levels when working in Restricted Access (Yellow) Zones,
- (h) Notify their supervisor if they become pregnant, or have/receive metallic implants or medical devices during the time they are engaged in RF EMR work and,
- (i) Notify their supervisor in the event of any over-exposure.

8.3. Radio Frequency Workers in Other Organisations

Other organisations working on operational TransGrid equipment will be approved Radio Frequency Workers under their own rules, but will not make inactive or isolate operational TransGrid Radio Frequency Transmitting Apparatus unless special arrangements have been made.

Other organisations working on their own Radio Frequency Transmitting apparatus will do so under their own rules.

9. Records

The personnel files of workers who are Authorised Category 8 and occupationally exposed to RF fields shall be identified and maintained so that retrospective health enquiries can be made. Such files shall be retained for the full duration of, and after termination of employment as required by law.

10. Change history

Revision no	Approved by	Amendment
1	Lionel Smyth, EGM/Network Services & Operations	6.6 and 6.8.2 updated to remove ambiguity in access zone definitions
2	Lionel Smyth, EGM/Network Services & Operations	3 improve clarity in description of RF EMR 5 minor editorial changes 6.2 amended to reflect changes to PSSR Rev5.1 for Cat 8
3	David Donehue, Acting Manager/Health, Safety and Environment	The document has been resissued with only minor changes to position titles.

11. Implementation

This procedure is to be implemented in conjunction with the implementation of TransGrid's Power System Safety Rules. It will be available as a resource, published on the Wire.

12. Monitoring and Review

The General Manager/Systems Operations is responsible for the ongoing monitoring and review of the documents associated with the Power System Safety Rules. This can include but is not limited to:

- (a) Requesting regular feedback on the effectiveness of procedures and work instructions. Appropriate feedback tools include focus groups and online assessments;
- (b) Where a change has occurred in our processes; and
- (c) Recommendations arising from incidents.

13. Attachment A – Access Management

13.1. Access Restriction

Access restriction is installed where the non-occupational exposure limits are exceeded. Access restriction can be installed:

- At ground level (<2m): Secure Barrier – 2m high palisade or cyclone wire fence.
- On a structure: Secure Barrier - 2m high fence around structure;
 - Locked ladder cage; or
 - Locked pole door.
- On a Rooftop (<2m): Secure Barrier – Locked rooftop door;
 - Locked rooftop ladder; or
 - Barrier around hazard area

13.2. RF Radiation Signage

Signage is to be installed to identify the presence of RF EMR exceeding the non-occupational exposure limits, signs shall be installed at access boundaries in the following positions:

“NO ENTRY” sign installed on the site/compound access gate

“RF Hazard Area” sign installed on the site/compound access gate and at base of pole, tower or structure

Concrete poles, wooden poles and steel towers must not be drilled or have their structural integrity altered when affixing signs, the preferred attachment method is to use stainless steel strapping.

Signs used at TransGrid sites are shown below.



Access Restriction Signage



RF Hazard Signage

13.3. Access Zones

Access zones are divided into three areas for an Active Radio Transmitting Antenna:

- General **White Zone** Access possible at any time;
- Restricted **Yellow Zone** Access limited to Radio Frequency Workers;
- Prohibited **Red Zone** No access.

The access zones are specified in the Site Management Book and shall be consulted prior to access.

No person is to enter the Prohibited Access Zones associated with an active Radio Frequency Transmitting Antenna.

Only Radio Frequency Workers may enter a Restricted (Radio Frequency Worker) Access Zone when a Radio Frequency Transmitting Antenna is active. The exposure level within the Restricted access zone is not to exceed Radio Frequency Worker maximum allowable absorption levels.

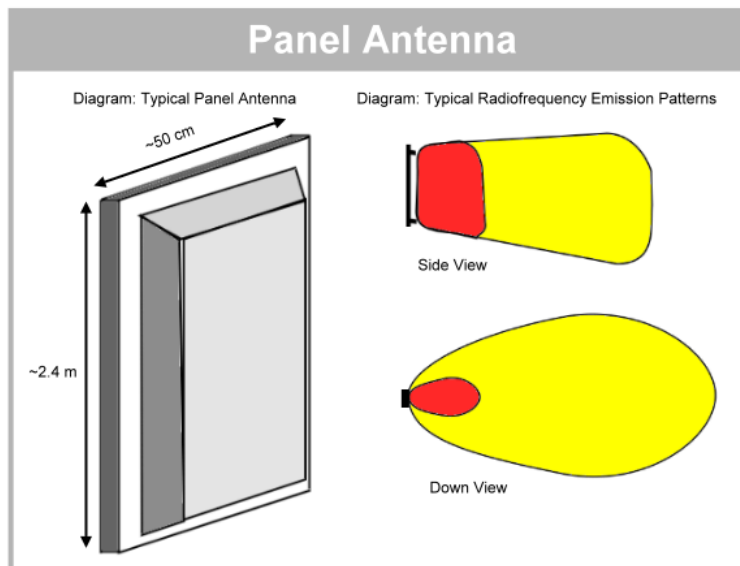
All persons shall sign the site log book prior to accessing the tower in the first instance.

In the event the Site Management Book does not identify an antenna with defined zones then the area in front of a parabolic antenna or immediately surrounding other antennas is to be considered a prohibited (Red) Zone.

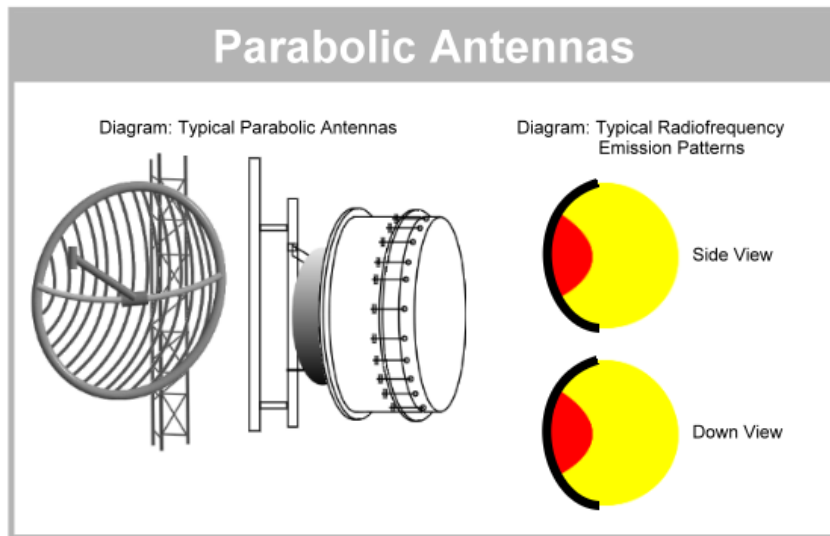
13.4. Radio Pattern and Access Zone Drawings

13.4.1. Radiation Emission Patterns from Telecommunications Equipment

Antennas that transmit information emit RF EMR (including microwave radiation). Each antenna has a specific emission pattern. The typical emission patterns for panel and parabolic antennas are shown below.

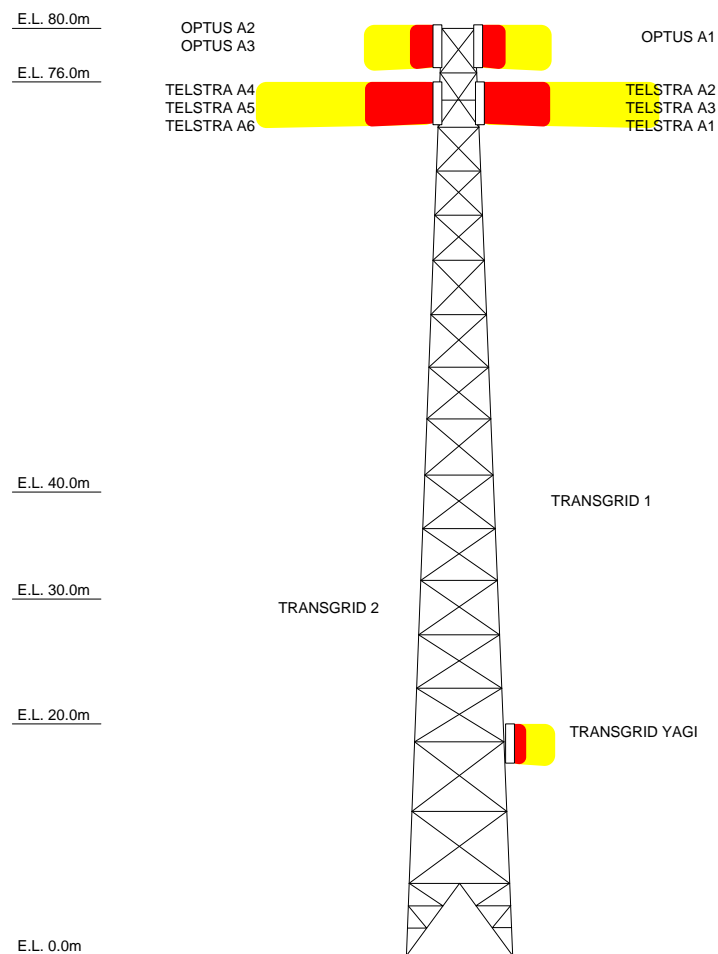


For panel antennas the zone of high field is highly directional, extending forwards from the front of the antenna, almost parallel to the ground. Where these antennas are mounted on high buildings or towers, RF EMR levels at ground level and in regions normally accessible to the public are many times below hazard levels

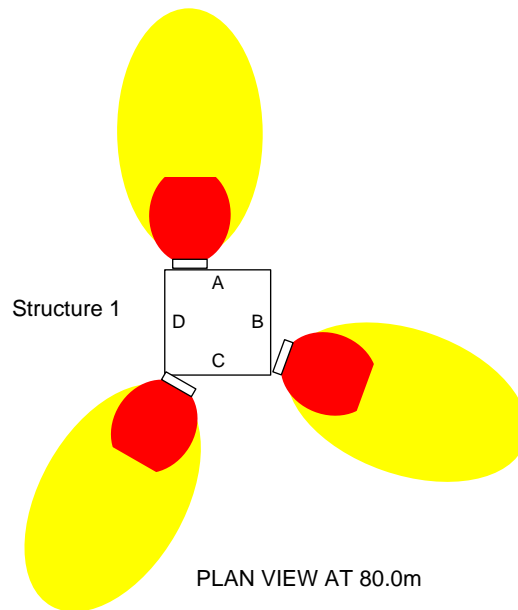


Parabolic antennas send or receive microwave radiation. The area where hazardous amounts of radiation exist is generally limited to within the radius of the dish.

13.4.2. Typical Elevation View



13.4.3. Typical Plan View



13.5. Site Management Book

The Site Management Book (SMB) manages RF information at transmitting sites, it is located within the building or on the outside of the building in an all weather enclosure. The Site Management Book must be consulted prior to accessing any radio transmitting structures. The Site Management Book contains:

- Site and after hours contact numbers;
- Site RF EMR Certificate;
- Measurement, Evaluation and Calculation Reports;
- Radiation Hazard Drawings;
- RF EMR Access Zones,
- Details of RF EMR Hazard Access Area Restrictions and Signage;
- Equipment, feeder and antenna list;
- Site Radiation Amendment return forms;
- Procedure for Suspected RF Over Exposure.

A log book to record access to the tower may be located within the Site Management Book or as a separate document on site.

In the event the Site Management Book is not available at the radio site:

- the Radio Frequency National Site Archive (www.rfnsa.com.au) can be consulted for available information;
- additional safe working methods will be required;
- contact your supervisor.

14. Attachment B – Personal RF EMR Monitors/Detectors

14.1. General

Only approved personal RF monitors/ detectors shall be used in RF EMR areas.

The personal monitor/ detector can be used as:

- A personal warning unit worn on the body; and
- A monitor unit, used to check that limit values are not exceeded in areas where humans are present. It can be held at arm's length or by an extension rod to reduce effects of being too close to the body.

14.2. Warnings

- The safety of persons within electromagnetic fields must not be based purely on the indicated values from this device (Not to be used without other controls);
- Never hold or place the unit inside field generating equipment or machines. Damage may occur resulting in erroneous operation;
- The unit has a limited frequency range;
- Secondary reflectors may result in local amplification of field strength. E.g. metal fences, poles, towers, guys, etc; and
- Measured values may be underestimated if a body is placed between the radiation source and the detector.

14.3. Operation, Inspection and Calibration

- The operation of an RF Monitor shall be in accordance with manufacturer's instructions.
- The Personal RF Detector performance needs to be checked before & after use.
- ARPANSA Standard requires that test equipment shall be calibrated at intervals as required, in accordance with AS/NZS 2772.2.

Local procedures shall be followed to ensure that instruments are properly tested, calibrated and records are maintained.