Amendment no. 1
(Supersedes ADI 0001 am0)

Automation Design Instruction

Radio communication site requirements

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51 Huntingwood Drive, Huntingwood NSW 2148

Postal address: PO Box 6366 Blacktown NSW 2148

Phone: 131 081 **Fax**: (02) 9853 6000

AUTOMATION DESIGN INSTRUCTION

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ADI 0001 – Radio communication site requirements

Contents

1.0 PURPOSE

To specify the installation requirements for radio and ancillary equipment at Endeavour Energy radio communication sites.

2.0 SCOPE

This Standard covers equipment and installation requirements at sites for microwave radio, stand-alone UHF base stations and repeaters.

This Standard does not cover:

- Design and installation of communication paths into or out of radio communication sites.
- Communications systems at substations or remote network asset sites.
- Communications shelters and associated civil design and construction.

3.0 REFERENCES

Internal

- Company Policy 9.2.9 - Electrical Network Telecommunications
- Company Procedure GSY 0045 - Safe Handling of Optic Fibres
- Division Procedure GNV 1051 – Working on structures with communications transmitters
- Automation Design Instruction ADI 0006 - Substation communication systems
- Earthing Design Instruction EDI100 – Distribution earthing design, construction and test
- Mains Construction Instruction MCI0003 – Attachment of communication transmitters to Endeavour Energy structures
- Mains Construction Instruction MCI 0005 - Overhead distribution construction standards manual
- Substation Design Instruction SDI 513 - Substation batteries and battery chargers
- Endeavour Energy Electrical Safety Rules

External

- *Occupational Health and Safety Act* 2000
- ENA National Electricity Network Safety Code (Doc 01-2008)
- AS 1768:2007 - Lightning protection
- AS 4262 - Telecommunication over voltages - Protection of persons (part 1–1995) & equipment (part 2- 1999)
- AS 3011.2:1992 - Electrical installations Secondary batteries installed in buildings - Sealed cells
- AS 4029.2:2000 - Stationary batteries Lead-acid Valve-regulated type
- AS2676.2:1992 - Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings - Sealed cells
- AS 4044:1992 - Battery chargers for stationary batteries
- AS4117:1999 - Surge protective devices for telecommunication applications
- AS 3000:2007 - Electrical installations (known as Wiring Rules)
- AS 3015:2004 - Electrical installations - Extra-low voltage DC power supplies and service earthing within public telecommunications networks
- AS3080:2003 - Telecommunications installations - Generic cabling for commercial premises
- AS 3835:2006 - Earth Potential Rise: - Protection of telecommunications network users, personnel and plant
- AS 5070:2008 - Siting and operation of radio communications facilities
- AS/ACIF S009:2006 - Installation requirements for customer cabling

- Motorola Standards and Guidelines for Communication Sites R56 Part No 68P81089E50
- ITU-T Standard K.27:1996 - Bonding configurations and earthing inside a telecommunication building
- ITU-T Standard K.56:2010 - Protection of radio base stations against lightning discharges

4.0 DEFINITIONS AND ABBREVIATIONS

ACMA	Australian Communications and Media Authority
ADI	Automation Design Instruction
EIRP	effective isotropic radiated power
FTP	fibre termination panel
HV	high voltage
LBS	load break switch
LV	low voltage
MEN	multiple earthed neutral
MPLS	Multi-Protocol Label Switching
OM3	Optical cable containing 50/125µm graded index multimode silica glass fibres with maximum permissible attenuations of 3.5db/km and 1.5db/km at 850nm and 1300nm respectively.
OS1	Optical cable containing 9/125µm step index single mode silica glass fibre with a maximum permissible attenuation of 1 db/km at 1300nm and 1500nm.
PDH	Plesiochronous Digital Hierarchy
rms	root-mean-square value
SCADA	Supervisory Control and Data Acquisition
SDH	Synchronous Digital Hierarchy
SNMP	Simple Network Management Protocol
WAN	wide area network
UHF	ultra high-frequency

5.0 ACTIONS

5.1 Safety

The design, construction and commissioning of communication systems shall be carried out in accordance with Endeavour Energy's Health and Safety Management Systems and the Electrical Safety Rules.

Systems shall be implemented and maintained to consider the range of human capacity, both physically and mentally, when designing substation communication systems.

Site safety in original construction and installation as well as any subsequent alterations and additions shall be managed as set out in the latest revision of AS5070 or the succeeding standard. Specifically:-

- Work on towers and support structures shall be carried out only by suitably qualified personnel.

- Rigging is conducted only by persons holding relevant statutory certificates and be properly equipped.
- Precautions to be undertaken in adverse weather conditions.
- Work not to be undertaken during electrical storm activity or heavy icing.

5.1.1 Optical fibre safety

Optical fibre and associated terminal equipment shall be handled with due safety considerations, as set out in GSY 0045.

5.1.2 Radio systems safety

Procedures for working near communications transmitters are set out in GNV 1051.

5.2 General

Endeavour Energy owns and operates a telecommunications network covering its franchise area to meet its operational requirements. The telecommunications network consists of a high capacity optical fibre, microwave links and low speed UHF subnetworks extending the reach of the radio network to substations, reclosers and load break switches.

5.3 Microwave links

Microwave links carry aggregated traffic and are designed on a case by case basis to operate at high reliability, the design and installation of which fall outside the scope of this document.

5.4 Microwave transmission equipment

Equipment will be selected on an individual site design basis. The equipment selection will depend upon:

- ACMA licence availability.
- Tower/site construction.
- Path length/terrain.
- Bandwidth requirement.

The microwave equipment shall be packet based and shall retain the ability to carry time division multiplexed data streams to support future protection signalling.

5.5 Routers and switches

MPLS Provider/Edge routers shall be used at radio sites for enabling converged service delivery.

5.6 Alarm reporting

The following alarms are to be provided from a radio site:

- Low voltage (12V and 50V) DC power system. (required)
- Mains fail. (required)
- Microwave terminal equipment failure (where microwave links terminate). (required)
- UHF terminal equipment failure (where UHF radio systems exist). (required)
- Alarms for each rectifier. (when available)
- Multiplexer alarms for all levels of hierarchy. (when available)
- Intrusion alarms for corporate security centre (for core sites only)
- Temperature. (when available)

A minimum of 16 digital inputs and 8 digital outputs shall be supplied to allow for connecting present and future alarms.

5.7 Equipment installation

5.7.1 Endeavour Energy equipment-only communication shelters

Where the communication shelter is exclusively occupied by Endeavour Energy equipment only, 19 inch open racks may be used.

5.7.2 Equipment in shared communication shelters

Where the communication shelter space is shared with third parties, lockable cabinets with 19 inch frame shall be used for housing microwave and optical fibre equipment. When required, (for example, a co-located TV transmitting station), cabinets designed with electromagnetic protection, shall be used.

5.7.3 Environment

Microwave, multiplexer and router equipment shall be installed in an air-conditioned environment. UHF only sites need not be air-conditioned but shall be designed to take advantage of cross flow and convection cooling while minimising ingress of dust particles into the shelter. Forced cooling may be used where convection cooling is inadequate, provided prior approval has been obtained from the Telecommunications Manager.

5.8 400MHz UHF radio network

The 400MHz UHF network consists of point-to-point and point-to-multipoint systems, connecting substations, auto re-closers, load break switches and other network equipment for SCADA communications.

The standard base station radio used in the 400MHz UHF SCADA network is listed in Annexure 3, capable of transmitting +37dbm (up to 5w) with a continuous 100% duty cycle and having a minimum receiver sensitivity of -106dBm.

Higher transmit powers may be used to overcome additional losses caused by filters interposed between the antenna and transmitter. The power delivered to the antenna and the resulting Effective Isotropic Radiated Power (EIRP) shall remain within licensed limits.

UHF radio systems shall be operated within the licensing conditions set out by ACMA.

- Point–to-point links, base stations and repeaters supporting substations shall have 1+1 hot standby configuration. The 1+0 configuration may be used where redundant links are utilised.
- Base stations and repeaters installed to support only auto re-closers and load break switches, may be configured without hot standby configuration.

5.8.1 UHF coaxial antenna feeder

Coaxial feeders used for 400MHz UHF systems shall have transmission characteristics and physical properties similar or better than:

- LDF5-50 Heliax for use with binary array antennae (base stations).
- LDF4-50 Heliax for use with Yagi antennae (point to point links).
- RG214 not longer than 5m as pigtails to make the coaxial cable more manageable near the radio.

5.8.1.1 Coaxial feeder installation

The external coaxial feeder shall directly terminate on the N type female connector in the antenna tail cable at the top of the tower (antenna) and on the coaxial surge arrester (see clause 5.15.5) mounted on a bulk head located close to the main internal earth bar. A tail cable shorter than 5m, similar to RG 214, shall then connect the coaxial surge arrester with the radio equipment.

Manufacturer's recommendations shall be followed regarding the minimum allowable bending radii of feeders.

Fastening of the coaxial cable to the supporting structure shall be by using stainless steel straps or hangers at intervals not greater than cable manufacturers' specifications. Where the intervals are not specified, spacing shall not exceed one (1) metre.

The coaxial feeder shall be installed and sealed in such a way as to prevent moisture ingress into the feeder at connectors or to the shelter at feeder entry plate.

Bird protection shall be used where a risk of bird damage is identified.

5.8.1.2 Coaxial feeder entry plate

Coaxial feeder entry into the shelter shall be through a purpose-built entry plate, vertically mounted above the external and internal earthing busbars.

5.8.2 Antennae

At communications sites where 400MHz is supported, where possible 2 x UHF antennae shall be installed and arranged as main and standby.

All nuts, bolts, U-bolts and washers, and structures mounting the antenna pipework shall be galvanised. Stainless steel antennae and accessories shall be used where corrosion and inter-modulation radio frequency harmonics are found to be a major problem.

Endeavour Energy has standardised on the antennae equipment specified in Annexure 3 and shall be the only material used in the installation.

Multicoupled antennae may be used where tower space is limited and tower owners do not permit individual users having separate antennae.

5.8.3 Duplexers

Duplexers allow the same antenna to be used for transmitting and receiving simultaneously.

Band pass/reject type duplexers, providing at least 70db of isolation at 9.5MHz offset, and offering less than one (1) db of insertion loss, shall be used on 400MHz UHF systems.

Endeavour Energy has standardised on the duplexer equipment specified in Annexure 3.

5.9 Signal cables

5.9.1 Optical fibre patch cords

- Single mode (SM) patch cords shall be OS1 duplex, consisting of rugged yellow jackets with LC connectors on the FTP side [AS 3080:2003].
- Multimode (MM) patch cords shall be OM3 duplex, consisting of rugged orange jackets with LC connectors on the FTP side [AS 3080:2003].
- The connector on the equipment side for both SM and MM connectors shall be chosen according to the respective equipment requirements.

5.9.2 Ethernet cables

Copper cabling used for the transport of Ethernet signals having bit rates of up to 100Mb/s shall be Category 5e or better, consisting of unshielded twisted pairs which are easier to terminate on site (than shielded cables). Shielded twisted pairs shall be used where the risk of electromagnetic interference exists [AS 3080:2003].

5.10 Distribution frames

5.10.1 Fibre termination points (FTPs)

Rack mounted fibre termination points shall be 19 inch with LC connector sockets mounted on angle adapter panels accepting a maximum of 48 fibre cores for each rack unit (RU).

5.11 Communication interfaces

Options for communications interfaces shall be:

- RJ45 electrical or SFP based optical Ethernet interface
- RS232 interface with DB9 connectors for speeds slower than 64kbps.

5.12 AC power supply

AC power wiring shall comply with the requirements set out in AS 3000:2007.

- A minimum two (2) double 10A general power outlets (GPOs) shall be readily available for miscellaneous use.
- AC power feed for rectifiers charging 48V or 12V battery banks shall be through suitably sized circuit breakers in the AC power distribution board.

5.13 DC power supply

The purpose of the DC power system is to achieve an uninterrupted supply to communication equipment; 48V DC and 12V DC be provided as required.

5.13.1 48V DC system architecture

The 48V DC power system shall consist of a rectifier rack and a minimum of two (2) battery banks in redundant configuration feeding a common load through DC distribution panels.

The positive 48V power rail of the system shall be bonded (at a suitable point nominated by the manufacturer) to the main internal earthing bar in a manner that a positive earthed supply is presented to the load.

5.13.2 Rectifiers

The rectifier rack shall:

- Consist of multiple plug-in rectifier modules capable of supplying sensitive telecommunications equipment [Type 4 in AS 4044:1992] with a maximum allowable ripple voltage without the battery of 0.2% rms at the nominal float voltage. The plug-in rectifier modules shall also provide N-1 redundancy by being able to recharge fully discharged battery banks within 24 hours whilst one module is out of service.
- Have an adjustable low voltage disconnect feature and the ability to limit the output current to a value equal to the sum of:
  - 150% of the anticipated initial maximum load current (to cater for present and future loads); and,
  - maximum battery charging current supplied by the manufacturer (if this figure is not available, use capacity in Ampere-hours divided by 10).
- Have circuit breakers sized for 150% of the anticipated initial maximum current on the outputs to the batteries and the DC power distribution panel (where the latter is separately mounted). Where the power distribution panel is integrated into the rectifier, a circuit breaker is not required between the two.

- Be 19 inch frame mountable.
- Be capable of remote supervision using the Simple Network Management Protocol (SNMP) through an RJ45 Ethernet port.

5.13.3 Batteries

Batteries constituting each bank shall be valve regulated lead acid (VRLA) type conforming to SDI 513, and be sized for supplying 150% (to allow for load growth and decline in performance) of the initial load requirement over a 24-hour discharge period.

Batteries in remote or difficult to access locations may be sized to 200% or greater of the load at the discretion of the Telecommunications Manager.

Batteries at Field Support Centres will be 300Ah or 5 hours backup, whichever is the greater. The load will be calculated to include the MPLS equipment, microwave equipment, corporate DC equipment such as routers, VOIP phone systems and 240VAC inverters. The battery cabinet and rectifiers should be sized to allow for future expansion to 600Ah.

5.13.4 Battery over- current protection and Isolation

Purpose built battery isolators containing circuit breakers, sized for the initial short circuit current the battery can deliver (figure supplied by battery manufacturer), shall be installed on both poles as close to the battery string as possible to provide over-current protection [AS 2676.2:1992], and isolation for maintenance.

5.13.5 12V DC system architecture

Where 48V DC power systems exist (microwave radio sites), 12V DC supply shall be derived using 48V DC/ 12V DC converters.

Where 48V DC power systems do not exist (UHF only radio sites), a 12V DC power system consisting of rectifiers and batteries, similar to the arrangement set out in clause 5.13.1 for 48V shall be used.

The negative 12V power rail of the system shall be bonded to the main internal earth bar at a suitable point, nominated by the manufacturer.

5.13.5.1 50VDC/12VDC converters

50V DC to 12V DC converters used to supply 12V shall:

- Be sized for supplying at least 150% of the initial maximum current to allow for load growth.
- Have N-1 redundant configuration.
- Have at least 1kV DC galvanic isolation between the 50V DC input and 12V output.
- Be capable of being remotely supervised and managed using the Simple Network Management Protocol (SNMP) over Ethernet port.
- Be supplied from a dedicated circuit breaker in the 50V DC power distribution panel (PDP) and be capable of output current limiting.
- Be 19 inch frame mountable.

5.13.6 DC distribution (48V and 12V)

A power distribution panel (PDP) shall be mounted at the top of each rack, one (1) each for 12V and 48V distribution. Where space permits, 12V and 48V distribution can be in the same PDP sub frame (refer to Annexure 3 for Endeavour Energy part numbers for PDP components).

DC distribution panels shall have dedicated circuit breakers for supplying individual equipment. These circuit breakers shall be sized for 150% of the initial maximum load current to allow for future load growth.

For smaller sites, power distribution panel may be integrated into the rectifier.

5.13.7 DC cables (48V and 12V)

Insulated cables used for DC cables shall be colour coded as below. They shall be clearly labelled at each end to indicate the operating voltage of the system (48V or 12V).

- Red for positive conductor
- Blue for negative 48V conductor
- Black for negative 12V conductor

5.14 Protection coordination

Given the intricacy of the power supply system, circuit breakers for AC feed to the rectifier and DC shall be chosen to provide sufficient level of coordination among them to ensure fault discrimination. [AS 3000.2007]

5.15 Earthing and lightning protection

5.15.1 General

The basic philosophy for protecting sensitive electronic equipment from lightning effects is to:

- Divert the lightning energy away from sensitive equipment
- Provide protection for all sensitive equipment.
- Single point earthing.

The earthing system shall be designed to conform or exceed the requirements of AS 1768:2007 and shall consist of an interconnected internal and external (with respect to communication equipment shelter) subsystem constructed to conform to the single point earthing concept. This configuration allows the equipment to rise and fall in potential, in step with the earthing system, without introducing damaging current loops during surge events.

Under this arrangement, the AC mains protective earth [AS 3000:2007], the 48V DC power system positive, 12V power system negative, the lightning protection system earth, metallic communication shelter frame, and underground metallic piping entering the site are all bonded together to form a single earthing system [AS 3015:2004].

5.15.2 Earthing resistance

The system shall be designed to keep the earth resistance to a value not exceeding 10Ω [AS 5070:2008].

5.15.3 External earthing sub-system

5.15.3.1 Air terminals

Air terminals 10mm in diameter [AS 1768:2007] solid copper or stainless steel vertical rod(s) not shorter than 500mm [AS 1768:2007] in length shall be mounted on top of the antenna tower to provide protection against direct lightning for the antennae and the communications shelter underneath. The maximum allowable length of a rod is 6m [AS 1768:2007].

5.15.3.2 Down conductors

There shall at least be two (2) 50mm² [R56] cross section copper down conductors installed to interconnect air terminals with the earthing system at the bottom of the tower.

5.15.3.3 Earth electrodes

Earth electrodes shall be solid copper rods of 12mm diameter [AS 1768:2007] with a minimum length of 3m [R56]. Minimum spacing between two (2) adjacent rods shall be the sum of their respective lengths [R56].

5.15.3.4 Buried conductors

Buried conductors shall be 25mm × 3mm solid copper strips, or 70mm² stranded bare copper, installed at depths below 500mm [AS 1768:2007].

5.15.3.5 Radial conductors

At least three (3) buried radial conductors, angularly equally spaced, shall emanate from the base of the radio tower. The minimum allowable and the maximum useful lengths of these radials shall be 7.4m and 24.4m respectively [R56].

5.15.3.6 Earthing rings (shelter and tower)

Two (2) earthing rings shall be installed, consisting of buried conductors, one encircling the communications building and the other encircling the radio tower. The two (2) rings in turn shall be bonded together by at least two (2) buried conductors at different locations. [R56].

5.15.3.7 Main external communication shelter earth bar

A main external earth bar, with its flat side in a vertical position, shall be installed on the exterior communication shelter wall immediately below the feeder entry plate and cable ladder. It shall be 6mm thick, 100mm wide, with a length (minimum 300mm) matching the width of the feeder entry plate and having 14mm diameter equi-spaced holes fitted with M12 bolts, nuts and flat and spring washers.

The spacing between the shelter wall and the earth bar shall at least be 40mm. The main external earth bar shall be bonded to the earthing ring encircling the shelter using two (2) insulated 120mm² copper riser earth straps [R56].

5.15.3.8 Cable ladder earthing

The cable ladder shall be bonded at one end to the tower by mounting clamps or bolts and at the other end to the main external earth bar using two (2) 35mm² earth cables.

5.15.3.9 Coaxial earthing kits

Coaxial cables shall be earthed, using appropriate earthing kits, at:

- the top of the tower near the antenna;
- the bottom of the tower where the cable enters tray/ladder;
- the cable entry plate; and,
- locations equally spaced (by no more than 25m) along the cable run between the points mentioned above.

5.15.4 Internal earthing sub-system

5.15.4.1 Main internal building earth bar

A main internal earth bar, with its flat side in a vertical position, shall be installed on the interior shelter wall immediately below the feeder entry plate. It shall be 6mm thick, 100mm wide, with a length (minimum 300mm) matching the width of the feeder entry plate having 14mm diameter equi-spaced holes fitted with M12 bolts, nuts and flat and spring washers.

The spacing between the shelter wall and the earth bar shall at least be 40mm. The main internal earth bar shall be bonded to the main external earth bar using an insulated (yellow/green) 70mm² copper earth cable.

5.15.4.2 Earth bonding cables

All the equipment cabinets inside the building shall be bonded to the main internal earth bar using insulated (yellow/green) minimum 35mm² [AS 1768:2007] copper earth conductors.

5.15.4.3 Bonding

Tinned copper lugs and stainless steel bolts shall be used to connect the equipment racks/cabinets to the main earth bars.

The AC mains protective earth shall be bonded through a *protective earth bonding terminal* to the main internal earthing bar using an insulated yellow/green earth cable 70mm² cross section to conform with the single point earthing principle.

This bonding conductor shall be as short as is practicable, and shall be clearly and indelibly labelled at both ends: *Earth bonding conductor* or *Equipotential bond*. The *protective earth bonding terminal* shall be installed in a convenient and readily accessible location adjacent to but not on or within the switchboard to which it is connected [AS3015:2004]. The arrangement is depicted in Annexure 2.

5.15.4.4 Dissimilar metals

Earthing lugs shall be tinned copper when attached to steel, galvanised steel or aluminium surfaces. Use of dissimilar metals in contact shall be avoided unless proven to be electrolytically compatible and approved by the Earthing and Power Quality Manager.

5.15.4.5 Earthing within cabinets

Cabinets shall be installed with a vertically mounted copper earthing bus bar 15 x 5mm or better to allow rack mounted shelves to be earthed. This shall be directly connected to the main internal earthing bar using insulated (yellow/green) minimum 16mm² copper earth conductors.

Earthing of the shelf mounted equipment shall be achieved using yellow/green stranded earthing conductors having at least 6mm² cross section [AS 3015:2004] conforming to AS 3000:2007.

5.15.5 Surge protection devices

5.15.5.1 Lines entering building

Coaxial feeders shall be routed through radio frequency surge arresters, conforming to the specification below, installed on a purpose built bulk head located near the entry plate. The bulkhead shall be bonded to the main internal building earth bar using an insulated (yellow/green) 70mm² copper earth conductor.

Coaxial surge arrester specification

Parameter	Requirement
Arrester	Gas discharge tube
Imax* (defined below)	at least 20kA**
Turn on voltage	90V< at 100 V/s
Frequency range	DC*** - 1000 MHz
Characteristic Impedance	50 ohm

Insertion loss	<0.1db over the frequency range
Voltage Standing Wave Ratio (VSWR)	<1.1 over the frequency range
Maximum radio frequency power	at least 50W Peak Envelope Power
Connection	N -type

* Imax is the peak value of the 8/20 µs wave shape current impulse that a surge protection device can successfully handle at least once [AS 1768:2007].

** Calculations are based on ITU-T K.56:2010.

**** Where DC feed through the coaxial cable is not required, surge arresters blocking passage of frequencies below 300 MHz shall be used to achieve the highest degree of surge protection.

All power and communication services shall enter or leave the shelter near the main earthing bars. Appropriate surge protection devices shall be installed between the main internal earthing bar, and:

- Power feed to tower top aircraft warning lamps.
- 240V AC power entering the building.

A multi-stage surge suppression device exceeding requirements for installations in a high lightning area (Category C3 in AS 1768:2007) having Imax value of 200kA, shall be used on both single and three phase AC mains circuits leaving and entering the communications shelter.

5.15.5.2 AC and DC lines inside building

A secondary surge protection device [AS 1768:2007], similar to those listed below, shall be installed on AC and DC distribution lines inside the building to further suppress the surge voltages appearing as a result of earth potential rise.

- Critec DIN rail mounted DSF20A275V across the phase, neutral and protective earth as close as practical to general power outlets and AC power input to the rectifiers.
- Critec DIN rail mounted DSD140 2BR 48 across the 48V DC negative and positive conductors as close as practical to the equipment being protected.
- Critec DIN rail mounted DSD120 1S 12 across the 12V DC negative and positive conductors as close as practical to the equipment being protected.

A lightning strike counter shall be installed on the antenna mast grounding wire at the base of the tower.

5.16 Pole mounted enclosures

Where radio equipment is required in a pole mounted installation, a stainless steel, galvanised steel or aluminium enclosure(s), as depicted in Annexure 1, shall be used.

- Installation of enclosure and antenna on the pole shall maintain a minimum clearance as per MCI 0003.
- Installation of earthing for both enclosure and antennae shall conform to EDI100 and installed as per MCI0005.

6.0 AUTHORITIES AND RESPONSIBILITIES

6.1 General Manager Asset Management

General Manager Asset Management has the authority and the responsibility for approving this Standard, including any variations.

6.2 Manager Asset Standards and Design

Manager Asset Standards and Design has the authority and responsibility for making recommendations to General Manager Asset Management in respect to this instruction.

6.3 Telecommunications Manager

Telecommunications Manager shall be responsible for coordinating the content of this document and

- ensuring that the requirements of this instruction are followed in the design, and construction of radio communications sites; and,
- keeping this instruction up to date.

6.4 Service Providers and contractors

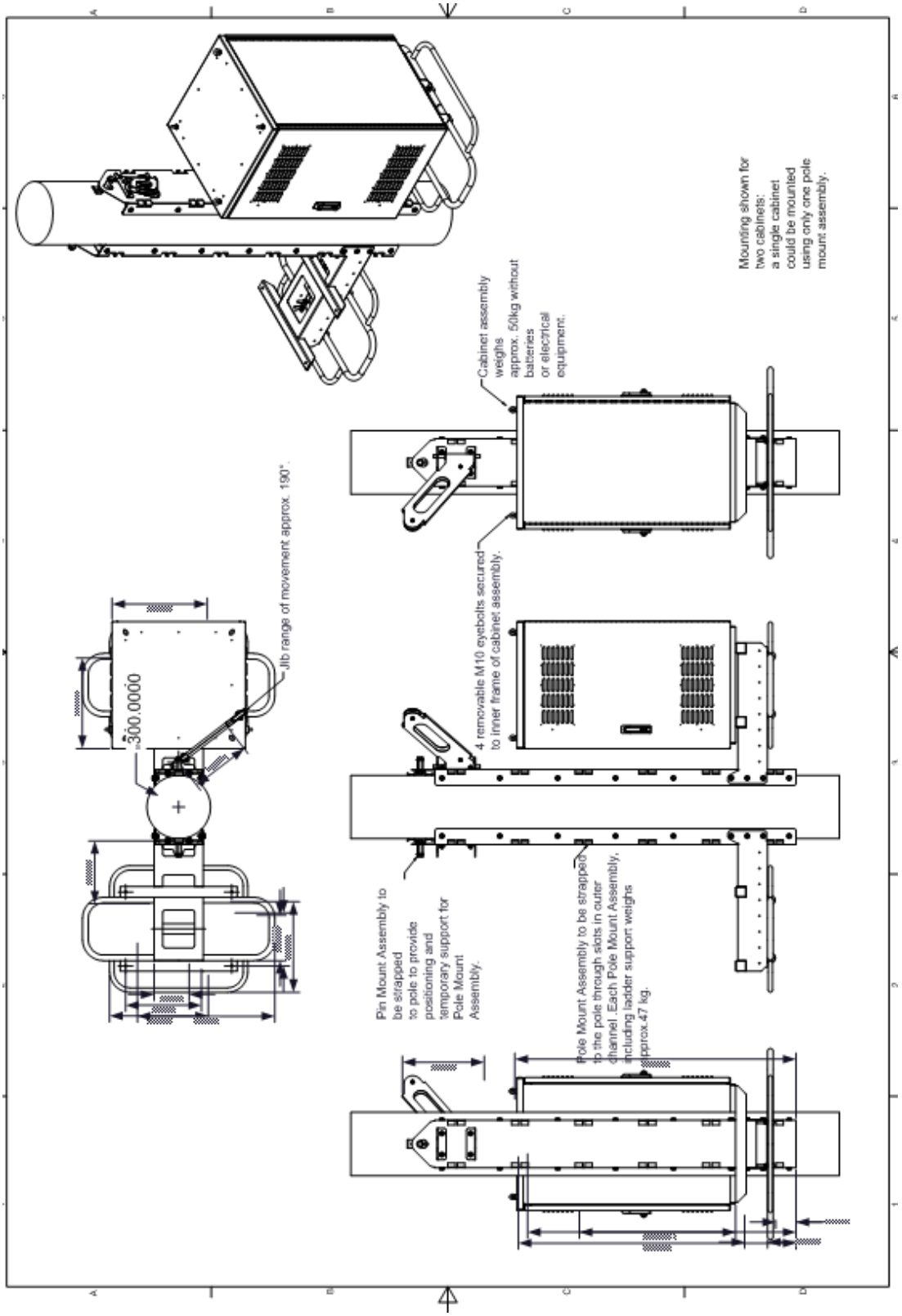
Outsourced Communications Service Providers and contractors shall be responsible for ensuring that equipment and accessories are installed and maintained to meet the requirements of this instruction.

7.0 DOCUMENT CONTROL

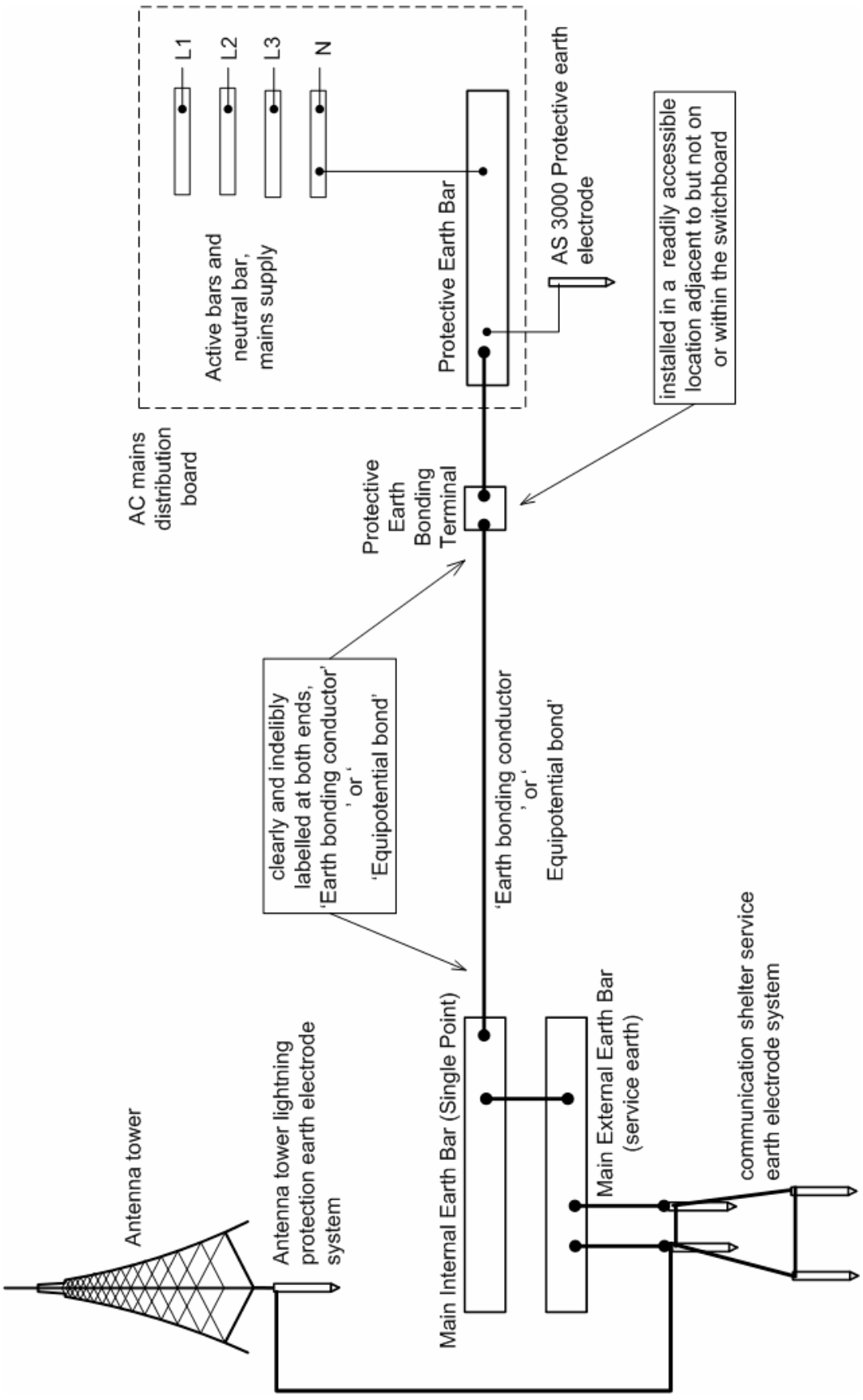
Documentation content coordinator: Telecommunications Manager

Documentation process coordinator: Branch Process Coordinator

Annexure 1: Pole mounted repeater enclosure



Annexure 2: Protective earth equipotential bonding conductor (from AS 3015)



Annexure 3: List of standard equipment required

Endeavour Energy has standardised on the following equipment in order to ensure compatibility of equipment and minimise costs of holding spares.

Store item code	Item name	Manufacturer's part number
1551365	UHF Yagi antenna (RF Industries)	YB6-61 9 dBd gain
1551373		YB9-61 14 dBd gain
1553643		YB 7 9 dbd gain
1551373		YB 10 11 dbd gain
1553643		YB6-65 9 dBd gain
1553650		YB9-65 11 dBd gain
1553668		YB16-65 12 dBd gain
1553585	UHF side mount dipole antenna (RF Industries)	2 dB gain ; SMD4-67
1553593	UHF binary array antenna (RF Industries)	Dual Omni; BA4040-67
1553601		Single Omni; BA40-67
1553619		BA80-67L
1553627		Single Omni; BA80-67
	Duplexer	D4547-0804-TRI from Triodatacom
1555028	Duplexer	Telewave TPRD-4544
	UHF equipment	As set out in current supply agreement contract
	Batteries	As set out in current supply agreement contract
	Communication equipment shelter	As set out in ETS0040 and current supply agreement contract
	Communication equipment cabinet	As set out in ADI0006 and current supply agreement contract
	Routers and Switches	MPLS P/PE routers set out in current supply agreement contract
	Microwave equipment	As set out in current supply agreement contract
	48 V Rectifiers	As per current supply agreement contract
	48V/12V DC-DC Converters	As per current supply agreement contract
	12V rectifiers	Cordex 2RU 12V modular rectifier
1554955	DC circuit breaker	50A DC (Merlin Gerin); Eaton;101510
1554989	DC circuit breaker	6A DC (Merlin Gerin); Eaton;101504
1554963	AC/DC circuit breaker	25A (Merlin Gerin) ;Eaton ;25803
1554971		16A (Merlin Gerin) ;Eaton ;25801
1554997	DC power distribution panel	24 way 3RU high; Eaton
1555002		24 way busbar comb. Merlin Gerin 100A; Eaton ;101499

