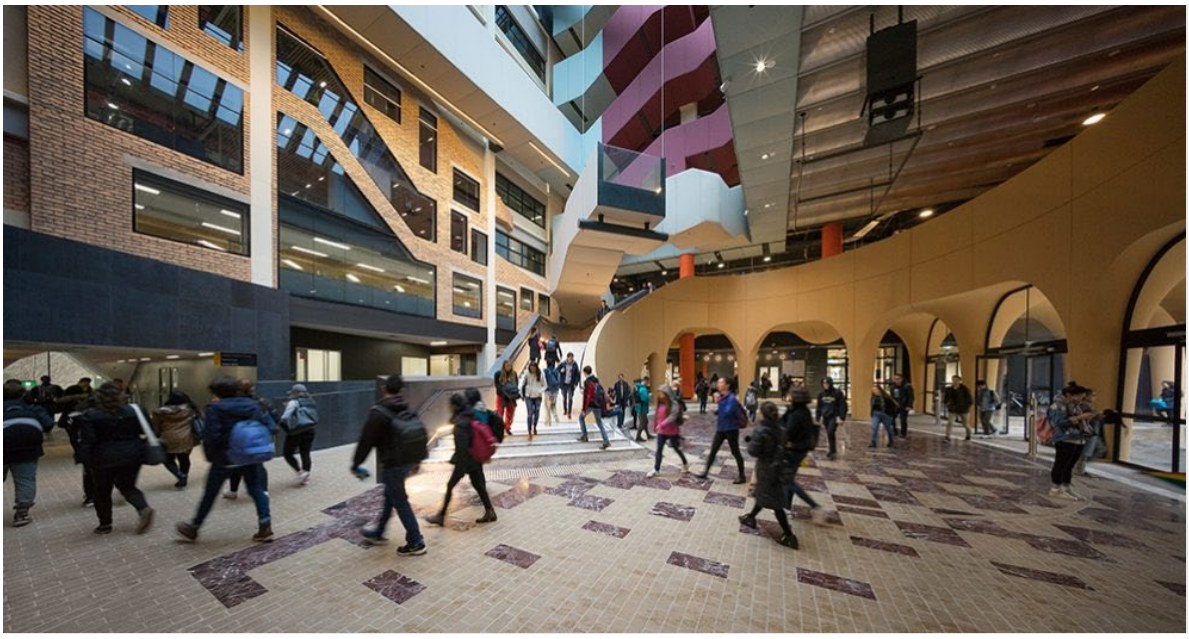
University Services

Business Services

Enterprise Technology– Networks & Telephony

Standards for the Installation of Communications Infrastructure (SICI)

Version 1.10



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1 DOCUMENT RACI

Activity	Document Section	Domain Architect	Solution Architect	Manager of Network & Telephony	Network Engineer	Manager Capital Works	Project Manager	Cabling Installer	Qualified Hygienist	Heritage Consultant	Building Architect
		Strategy, Innovation & Assurance		Enterprise Technology		UoM PM		External Contractor			
Document Updates											
Material changes to the document		C		A	R	CI					
Non-material updates to the document		I			R/A	I					
Approvals											
Consideration and approval of all cabling designs prior to any works				I	R/A		I				
Consideration and approval of all tender specifications related to communications infrastructure, prior to release to market				I	R/A		I				
Notification of variations					I		R/A				
Approval to proceed with works					R		A	I			
Prior notice of commencement of works					I		I	R/A			
Exception											
Consideration and approval to install non-standard racks	4.4.4				R/A		I	I			
Consideration and approval to install copper cabling other than Cat 6A F/UTP	5.1.1				R/A		I	I			
Consideration and approval to install UTP outlets on public/general purpose areas	5.1.4			A	R		I	I			
Consideration and approval for non-standard wireless AP mountings	9.3			A	R		I	I			I
Consideration and approval to increase the maximum number of prescribed UTP outlets	5.1.4				R/A		I	I			I
Consideration and approval of surface mount ducting material and colour							R/A	I			I
Mediation of conflicts between aesthetical considerations and wireless service		C	R	A	I	I	I	I			I
Contractor Conduct											
Contractor Induction							A	R	R		
Providing access to UoM communications for third party contractors					R		A	I			
Providing access to UoM pits and conduits	4.3.5				I		R/A	I			
Division 6 Hazardous Materials Audit					I		A	I	R		
Reporting of hazards				I	I	I	I	R/A			
Overall cleanliness of work areas							A	R			
Heritage											
Undertaking of heritage assessments and impact considerations							A	I		R	
Establishing prior or existing heritage overlays or restrictions							R	A			
Inspections											
Wireless deployment; initial site inspection	9.3.6				R		A	R			
Wireless deployment; in progress (rough-in) inspection	9.3.6				R		A	R			
Wireless deployment; completion inspection	9.3.6				R		A	R			
Post Installation											
Authoring and distribution of post installation documentation	4.2.17										
Procurement of communications equipment	4.4.1				A		R				
Installation, removal, modification or configuration of UoM communications equipment	4.4.1		I		R/A						
Testing of new cabling infrastructure	5.1.8				A		I	R			

Distribution of all relevant test results to engaged stakeholders	5.1.8				I		A	R				
Approval for network activation	5.1.10			A	R		I					

2 INTRODUCTION

The purpose of this document is to detail physical standards associated with the installation of communications infrastructure at University of Melbourne (herein 'UoM) designated sites.

3 OVERVIEW

3.1 Introduction

This document describes the standards for the installation and/or modifications of communication infrastructure at the University of Melbourne (herein 'UoM').

The objective of this document is to define a universal and standardised communications infrastructure, with the view of minimising deployment and operating cost and thus total cost of ownership.

This document provides external parties with detailed specifications and the minimum standards for use in the construction or remodelling of buildings and facilities occupied by UoM.

It is expected these specifications and standards are incorporated into relevant project artefacts, to ensure all outcomes meet the specific needs of the University.

All cabling work at UoM designated sites must comply with these standards in addition to any other relevant Australian and international standards.

3.2 Service Ownership

The UoM Communications Infrastructure Service is owned by the Technology Management department of Infrastructure Services, a division of the University Services, (herein referred to as 'Technology Management'). The group is responsible for overseeing the design, installation, and operation of all campus communication infrastructure.

Within Technology Management, the Network and Telephony group maintain ultimate accountability for the design and operation of communications rooms, ductwork, cabling and radio spectrum, both inter and intra building, supporting the UoM's diverse requirements for voice and data services.

To maintain a consistent approach throughout all UoM sites, UoM Infrastructure Services Technology Management is the only entity authorised to approve additions or alterations to communications infrastructure within any UoM designated site.

3.3 Responsible Parties

The Construction – Planning & Delivery department (herein 'UOM') of Project Services, another division of University Services, provides planning, governance and oversight of all construction projects conducted on UoM sites.

UOM facilitate the primary engagement point for external parties contracted in the delivery of communications infrastructure on UoM sites

The Enterprise Architecture (herein 'EA') group, within Infrastructure Services, maintained ownership of these standards and specifications and is the only entity authorised to approve additions and alterations to these standards.

Written approval must be obtained from the Domain Architect for Network and Telephony.

3.4 Contacts

Contractors are directed to liaise only with their designated UOMcontacts as agreed at the commencement of each Project for all questions regarding this document.

4 CODES OF PRACTICE

The following section provides general standards as applied to the installation of communications infrastructure.

All work performed under the scope of this specification shall conform to the following codes and standards where applicable. When a conflict occurs, the Contractor is directed to follow the most stringent requirements.

When referring to the following University of Melbourne standards it is essential that the latest revision be used. The revision date of this document may be found on the cover page.

This Specification must be read in conjunction with UOM) UoM standards and polices. More information about UOM standards and polices can be found at

https://staff.unimelb.edu.au/campus-maps-facilities/contractor-guide?_ga=1.136775161.870467222.1448419896

4.1 Criteria

There are two categories of criteria:

If the words are:	The criterion is:	Generally applies to:
Must or shall or shall not	**Mandatory**	protection, performance, administration and compatibility and they specify the absolute minimum acceptable requirements
Should, may or desirable	**Advisory**	Enhancing the performance and usability of the cabling infrastructure.

4.2 Specifications

4.2.1 Conditions of Contracts & Safety

Conditions	Description
Standards Compliance	Adherence to this Standard by contractors is a condition of contract. These Standards are an appendix of the Project Management and Design Standards as issued by the UOM
Letting of Contracts	The Technology Management division of Infrastructure Services maintains sole responsibility for the specifications and design of UoM communications infrastructure. Contracts for structured cabling systems and/or other minor works shall be let solely by UOM. Contracts would be let and managed at the request of the relevant department or faculty. Contractors working on campus must appear on the UOM maintained list of inducted contractors. This requirement applies to all levels of sub-contract.
Hazard Assessment	In accordance with Victoria OHS Regulations (2007), contracts for cabling work shall only be let where a Division 6 Hazardous Materials Audit has been carried out. Areas that have an audit and have not been subjected to the installation or modification of other services during the currency of the audit are exempt from this requirement. The audit shall include hazardous materials (including asbestos) and environments (including electrical shock hazard and confined spaces). The Division 6 audit shall be carried out by a qualified hygienist at the expense of the requesting department or project. Contractors wishing to establish the existence of a Division 6 audit for a given area may do so through UOM. In the event that a contractor encounters an electrical power cable that represents an obstacle or hazard, the contractor (or agent) shall contact the UOM Project Manager for a safe resolution to the problem.
Contractor Induction	All contractors undertaking work on University premises shall have attended a Special Conditions of Contract induction session, held by UOM.

4.2.2 Approved LAN Designs

All building communications infrastructure and cabling designs shall be approved, in writing, by Technology Management, prior to installation.

Designs for consideration shall be submitted, by the appointed UoM Project Manager, to Technology Management for review and potential approval.

Tender specifications, schematics and/or floor plans shall be submitted, by the appointed UoM Project Manager, to Technology Management for approval prior to the issuing of documents for tender.

Any cabling installation that does not comply with this Standard shall not be connected to the UoM network infrastructure.

4.2.3

4.2.4 Sustainability

All communications infrastructure installations shall consider environmental and sustainability implications. Installers are directed to indicate what environmentally aware products and methodology are included in their contract and work practices

4.2.5 Aesthetics

All cabling installations shall be compliant with UoM aesthetic requirements. These requirements fall into the following categories:

a) General Access Areas

Encompasses all teaching spaces (theatres, common learning spaces, classrooms, tutorial rooms, etc.), offices, corridors, foyers, lift wells/landings and toilets.

- All cabling shall be concealed within wall and/or ceiling cavities to the extent that is practically possible. Access hatches shall be provided.
- In cases where such concealment is not possible, surface mounted duct fitted with a removable lid shall be supplied. Samples of the proposed duct shall be submitted to the UOM Project Manager for final approval prior to commencement of any work on site.
- Ductwork is to be located on the wall or ceiling as high as possible. In circumstances where a continuous duct plane cannot be achieved due to existing structure or services, the appropriate duct height shall be determined on site by the UOM Project Manager.
- Horizontal ducting runs to desktop outlet(s) shall be mounted either at skirting level or immediately above the workstation surface. In cases where GPO's are mounted above the workstation, consideration should be given to the distance between the GPO's and the workstation surface, in relation to the possible use of plug-packs. In cases where duct is mounted at skirting board level, the provision of penetrations in the workstation surface to accommodate power and data lead shall be made part of the design. Desks fitted with modesty panels shall not be used in locations that obscure data or power outlets.
- Allowance should be made by the contractor to specify PVC duct that matches the colour of the supporting wall. Samples shall be submitted to the UOM Project Manager for approval prior to commencement of work on site. The use of Metal PVC duct and/or conduit shall be regarded as an option of last resort.

b) Public Restricted Areas

Plant-rooms (basement, individual floor and roof), crawl spaces, under crofts and roof space voids.

Cabling in these areas shall be supported on hot-dipped galvanized tray. Tray shall not be installed at a height less than 2100 mm above the horizontal of the finished floor.

c) Generic Workmanship

In circumstances where a cable route is required to traverse a construction project in progress, the higher aesthetic standard/technique shall prevail within that space. Penetrations to walls, ceilings and floors shall be kept to a practical minimal sizing. Any damage to the building fabric resulting from such penetrations shall be made good as follows:

- No damage shall be visible beyond the confines of the duct or service outlet boxes.
- The fabric shall be restored to the original standard, including colour matching.

The contractor shall ensure that all areas surrounding the work area are kept clear of all materials, dust and handprints through to the completion of works, subject to the satisfaction of the UOM Project Manager.

4.2.6 Heritage Compliance

Numerous buildings on UoM designated sites appear on the Victorian Historical Buildings register and/or are covered by City of Melbourne planning overlays, associated with landmarks of historical significance.

Prior to commencing any destructive or intrusive activities within a UoM designated building, the external party / contractor shall confirm what, if any, heritage restrictions apply.

The external party / contractor is directed to liaise with the assigned UoM project manager or UoM responsible party for confirmation.

Prior to commencing any destructive or intrusive activities is it the responsibility of the external party / contractor to confirm all necessary building and works permits have been issued and approved, as they relate to heritage considerations. The external party / contractor is directed to liaise with the assigned UoM project manager to confirm approvals.

The external party / contractor shall conduct works in adherence to all regulatory, legislative and permit requirements, as they relate to heritage considerations.

These include (but are not limited to) the following:

- UoM specific policy and regulations
- Local planning schemes
- Victorian heritage legislation

4.2.7 Sub-contracting

In the case installation work being sub-contracted by the prime contractor, a copy of this Standard shall be provided to the subcontractor by the prime contractor. This requirement shall cover all levels of sub-contracting. Sub-contractors must also be inducted.

4.2.8 Notice of Works

Prior to commencing any installation works, a minimum of forty-eight (48) hours' notice shall be given, in writing, to the designated UoMUOMProject Manager who is responsible for liaising with Enterprise Technology and other relevant stakeholders potentially impacted by any proposed works.

4.2.9 Variations

Any variations to the issued job specification by the requesting Department shall be referred for approval to the designated UOM Project Manager who is responsible for liaising with Enterprise Technology and other relevant stakeholders.

The UoM has no obligation to consider or approve requests for substitution after award of contract.

4.2.10 Site Access

Site access to any UoM communications room shall be arranged for the external party in consultation with the designated UOM Project Manager; they will then liaise with Enterprise Technology and other relevant stakeholders where required.

4.2.11 Site Enquiries

Any questions regarding site conditions should be referred to the designated UOM Project Manager who will contact Enterprise Technology and other relevant stakeholders where required.

4.2.12 Approved Cabling Product Manufacturer

UoM shall only accept cabling and systems from the following approved manufacturers:

- Panduit International Ltd (Panduit) for **copper** cabling
- AFL (formally AFC Group Pty Ltd (AFC) for **fibre** cabling).

4.2.13 Certifications

All integrated structured cabling on UoM designated sites shall be carried out by either:

- A current **Panduit** certified installer for copper/UTP installations or;
- An **AFL** certified installer for fibre installations.

4.2.14 Installation Warranties

All structured **copper** cabling installations shall be covered by a minimum of twenty five (25) years warranty.

All structured **fibre** cabling installations shall be covered by a minimum of twenty (20) years warranty.

A contractor with full Panduit and/or AFL endorsement and certification for the cabling system tendered shall perform the work and shall provide the signed Panduit or AFL System Certification and Warranty on completion.

4.2.15 ACMA Requirements

All cabling work on the UoM designated sites shall be carried out by personnel who are registered under the Telecommunications Cabling Provider Rules 2014 (CPRs).

All cable and cabling products installed by the contractor (voice or data) shall, as a minimum, comply with the relevant Australian Standards. These include (but are not limited to) the following:

Standard	For
AS/NZS3080:Current Edition	Telecommunications installations - Generic cabling for commercial premises.
AS3084:Current Edition	Telecommunications installations – Telecommunications pathways and spaces for commercial buildings
AS/NZS3085.1:Current Edition	Telecommunications installations – Administration of communications cabling systems – Basic requirements.
AS/NZS14763.3:Current Edition	Telecommunications installations - Implementation and operation of customer premises cabling - Testing of optical fibre cabling
AS/NZS61935.1:Current Edition	Testing of balanced communication cabling in accordance with ISO/IEC 11801
AS/ACIFS008:Current Edition	Requirements for authorized cabling products.
AS/ACIFS009:Current Edition	Installation requirements for customer cabling (wiring rules).

The current edition shall be the last edition published up to one month prior to the closing date of the Tender or Request For Quotation (RFQ).

Such installations shall also meet all requirements as set out in this Standard.

4.2.16 Building LAN Infrastructure

All new and additional building integrated communications cabling installations shall be made using ISO/IEC 11801 **Category 6A foil shielded / unshielded twisted pair (F/UTP) to a Class EA standard** and/or **OS1 Single Mode optical fibre**.

4.2.17 Documentation

The contractor will provide the UOM UOM Project Manager with cabling installation documentation at the completion of the works, **no less than ten10 business days prior to the cabling commissioning date or as agreed with UoM Project Manager & Network Engineer .**

This requirement shall also apply to each stage of a multi-staged project.

The documentation shall include (but is not limited to) the following artefacts:

ID	Artefact	Purpose	Format
	Floor Plan (As-builts)	Illustrating outlet number and location, consolidation point (CP) location (where applicable) and all major cable routes	CAD documents. Documentation shall be presented in electronic format and comply with P&C CAD standards document *CAD STANDARDS (latest revision*
	Testing Results	Test results shall have the fields: Building number Building name, Floor number and Outlet number as prescribed by these Standards.	Native electronic format. Result viewing software shall be made available upon request of the University.
	Certification	Vendor specific structured cabling certification documents (can be provided)	
	Inter-building Route Plan	Inter-building cable routing shall illustrate building penetrations, pit locations, route followed, MDFs	CAD document, shall be presented in electronic copy, route overlayed on University CAD Diagrams, must comply with UOM CAD standards

4.3 Cable Installation

4.3.1 General

All cable and cabling products that form part of a communications cable installation shall be specified and installed only with the approval of Enterprise Technology.

In multi-story installations, cables shall not be installed between floors except via an approved communications cabling riser or duct. All fire-rating materials removed for the installation of cables shall be replaced such that the original fire rating is preserved.

In cases where adherence to the mandatory separation rules is problematic, the data cables in question shall be housed in PVC conduit or duct over the route length in dispute.

Non-terminated “future capacity” cables are not permitted on UoM designated sites, unless explicitly exempted. All installed cables on shall be terminated at each end and documentation, labelling and test results shall be provided.

This applies to **all** permanently installed cable types.

4.3.2 Compliance

All cabling installation shall be done so in accordance with **AS/ACIFS009:2006 Installation Requirements for Customer Cabling (Wiring rules).**

4.3.3 Intra Building Cabling

- Cabling between individual communications rooms and cabinets, within a building, shall comprise a minimum twelve (12) cores of Class OS1 optical fibre.
- Interconnection made using F/UTP shall not be permitted.
- Interconnections made using OM1, OM2 or OM2 multi-mode fibre shall not be permitted.

4.3.4 Inter Building Cabling

- Cabling between individual buildings shall comprise a minimum twelve (12) cores of Class OS1 optical fibre.
- Interconnection made using F/UTP shall not be permitted.
- Interconnections made using OM1, OM2 or OM2 multi-mode fibre shall not be permitted.
- All buildings shall be connected to the UoM Network Core via two (2) physically diverse cable routes. The destinations of the two cable routes shall provide connection to two disparate patching nodes.
- Path and patching node selection is at the discretion of Enterprise Technology and shall not be performed by the contractor or UOM.

4.3.5 Inter Building Cable Housing

d) Access

All duct, pits, conduit and cable (optical fibre and copper) owned by the UoM shall be regarded as UoM property. Access to such property shall be made through formal agreement via the UOM Project Manager.

e) Installation

All cables installed beyond building perimeters shall be enclosed/supported as specified for the following environments:

Environment	Requirements
Trenches	White PVC conduit with a **minimum** inside diameter of one-hundred (100) millimetres.
Tunnels	Galvanized cable tray with a **minimum** size of seventy-five (75) millimetres,
Pits	The minimum size shall be 'P5'. The pit shall be fitted with a traffic-rated reinforced concrete lid, bearing a nameplate inscribed "University of Melbourne Communications". The pit shall be dimensioned such that the cable manufacturer's minimum bend radius specification is not exceeded. A minimum of one pit per one-hundred metres (100m) of conduit/duct shall be installed. A new pit shall be installed for each change in conduit direction.
Building external walls	UV stabilized white PVC conduit. The use of exposed tray is not permitted. External cabling shall only be permitted with the express approval of the UOM Project Manager
Building Penetration	There shall be two (2) building penetrations to allow redundancy.

At the time of installation, all new tray, duct and conduit shall be dimensioned to provide a minimum of 50% growth capacity

4.3.6 Intra Building Cable Housing

All cables installed within a building perimeter shall be contained or supported as follows:

Area	Requirement
Communications risers	• Galvanized cable tray or PVC duct. • Catenary supports shall not be used. • Floor penetrations made in concrete slabs as part of a communications riser shall be sleeved with PVC conduit (white). • The sleeve shall be cut flush with the surface of the slab or wall at each end.
Exposed areas (ceiling area or wall space)	• PVC duct or conduit. • Galvanized tray may only be used in communications closets/rooms and plant rooms. Other areas may be exempted at the discretion of Enterprise Technology • Cable trays and cat wire for branches from trays.
Above false ceilings (suspended)	# of UTP cables — Support them with <= 24 — Catenary wire or "J" Hook > 24 — Galvanized trays • Cable routes are to avoid close proximity (no less than 300 mm) with fluorescent light fittings. • Cables are not permitted to be in contact with any part of a false ceiling.
Under floor	# of UTP cables — Support them with <= 24 — Catenary wire or "J" Hook > 24 — Galvanized trays • • This installation method is not preferred and therefore written approval shall be obtained from Enterprise Technology prior to any **design** of underfloor cabling is to commence • Full Cable routing plan is to be provided prior to commencement for consultation • Minimum height required between the concrete slab and the underside of the false floor shall be 400mm • Trays shall be used for the main cable pathway • Catenary wires shall be used and all change in directions shall be made at 90 degrees • Where access is limited (ie desks directly above proposed non-main pathways), PVC duct shall be installed from the main pathway to the respective floor box/penetration. • In circumstances where a catenary cable is impractical due to inadequate access and/or obstacles, PVC duct and/or hose may be used instead, only with written approval from Enterprise Technology (Network Access). • No cables shall be in direct contact with the lower surface of the under-floor space. • Cable mats shall not be used • Painted cable pathways shall not be used • Floor tiles must be used to provide access at key junctures; joins, turns, main pathways • Progress installation photos/inspections required at key junctures that is; during subfloor build, during pathway install, during cable install • Separation from all electrical services shall be maintained in accordance with Australian Standards • Cabling shall not reticulate beneath the racks within a comms room. All cabling entering the racks shall reticulate from above trays. (ie sub floor cables will be required to go up the wall within the comms room to trays above then enter the racks from above) • Routed Data Cables should be fixed to the galvanised tray using velcro ties in groups of 24 cables maximum

4.4 Communications Equipment & Environment

4.4.1 Equipment

The installation, removal, modification or configuration of UoM communications infrastructure shall only be carried out by Enterprise Technology or authorised representatives.

Any network specific infrastructure components purchased under a building works program shall also include twelve (12) months software and hardware maintenance.

Communications infrastructure components include (but are not limited to) the following:

- Switches
- Routers
- Wireless access points
- Firewalls
- Terminal servers
- Telephony handsets
- Telepresence and collaboration units
- Carrier Customer Premise Equipment (CPE)

All necessary networking equipment to enable outlets in building works shall be funded by that project and will be procured only Enterprise Technology.

Procurement of networking equipment shall be consisted with the published Technical Reference Model (herein 'TRM'). Further information can be obtained from Enterprise Technology.

4.4.2 Communcation Room and euipment location

UoM communications infrastructure shall only be located and housed in spaces complying with the UoM "Computer and Network Accommodation Strategy" (CANAS).

The location and housing of communications infrastructure shall be clearly defined in the project/building design documentation and have the written approval of Enterprise Technology and the requesting faculty.

The construction of all communications locations shall comply with the University "Computer and Network Accommodation Strategy" (CANAS).

4.4.3 Communications Rooms

4.4.4 Rack Specifications

Appendix A defines the standard rack layouts and approved part numbers.

Perspex or **glass** panels shall not be used

Cabinet	Requirements
Floor Standing (Full Height 45RU)	• Shall be deployed consistent with the Standard Rack Layouts defined in Appendix A • Shall be deployed according to the UoM "Computer and Network Accommodation Strategy" (CANAS).
Floor Standing (Half Height 24RU)	• **Shall not be deployed without written approval of Enterprise Technology**. Requirements and justification(s) must be submitted to Enterprise Technology for consideration. • Shall be deployed consistent with the Standard Rack Layouts defined in Appendix A • Shall be deployed according to the UoM "Computer and Network Accommodation Strategy" (CANAS).
Wall Mounted	• **Shall not be deployed without written approval of Enterprise Technology**. Requirements and justification(s) must be submitted to Enterprise Technology for consideration. • Shall be deployed consistent with the Standard Rack Layouts defined in Appendix A, or as agreed with UoM Networks team. • Shall be deployed according to the UoM "Computer and Network Accommodation Strategy" (CANAS).

4.4.5 Cable Support & Dressing in Cabinets & Racks

- Suitably dimensioned cable tray or ducting shall be installed to support horizontal and vertical cables leading into all open racks and cabinets.
- Open racks shall be fitted with full height, front and rear, vertical cable management ducts.
- Field and link cables shall be led into the rack via the rear ducts. Refer to Appendix A for Standard Rack Layout and part numbers

Note: All new cable management and support systems shall be designed with a minimum of fifty percent (50%) growth capacity when initially installed

4.4.6 Labelling

Each rack within a communications room shall carry a unique identification label containing the room number and a sequential number, (for example 245-1 will be the first rack in communications room 245).

4.4.7 Electrical Earthing and Bonding

- All data/communications racks and cabinets shall be connected to the building protective earthing system, by means of an individual six (6) mm^2 grounding kit strap, tapped off a main run of overhead or underfloor earthing of sixteen (16) mm^2.
- A max of ten (10) Ohms shall be maintained to any and all racks/cabinets.
- Multiple cabinet earthing shall not be connected in series.

4.4.8 Equipment Cooling

- All data cabling and patching shall be routed to avoid disrupting the flow of cooling air to and from any in-situ ICT infrastructure.
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5 COPPER TWISTED PAIR CABLING

5.1 General Specifications for Structured Communications Cabling

5.1.1 Cabling Configuration Constraints

All new building integrated communications cabling installations shall be made **ANSI/TIA-568-C.1 Category 6A unshielded twisted pair (U/UTP) or foil shielded / unshielded twisted pair (F/UTP) to a ISO/IEC 11801 Class EA standard**, with the following caveats:

- Maximum link length shall be ninety metres (90m).
- Maximum channel length shall be one hundred metres (100m).
- Maximum number of stations per segment shall be one (1).
-

5.1.2 Installation Standards

The cabling system shall include (but are not limited to) the following:

i. All patch panels
ii. Horizontal cables
iii. Vertical cabling
iv. Modular jacks
v. System cables
vi. Patch cables
vii. Drop-leads
viii. Cable management
ix. Physical support systems
x. Comprehensive labelling system conforming with Section 5.1.5

The cable interconnecting a network outlet and a horizontal distribution panel or patch panel shall be of one continuous length with no intermediate joins, splices or taps.

Additions, repairs or refurbishments of existing Category 5, 5E & 6 structured cabling shall be made using Class EA (Cat 6A UTP).

5.1.3 Installation Warranty

All new cabling installations shall include a minimum twenty-five (25) year Panduit warranty. Such warranted cabling systems shall cover the installed cabling and include all patch and drop cables.

All new cabling installations shall be carried out by an installer who is Panduit-certified at the time of tender submission.

5.1.4 Outlet Provisioning

The following information represents a **maximum** requirement for the number of UTP outlets that shall be installed in each type of workspace:

NOTE: all UTP cable runs need to be terminated on a patc panel in the comms room and field end on a wall plate – No direct cables runs are permitted

Functional Space	Outlet Provisioning Specifications
General Staff or Post Graduate Offices and Workspaces	A maximum of **one** (1) outlet shall be cabled to each staff or postgraduate office or workspace. The number of outlet shall be based on user requirements or as stipulated by the project.
	Please refer to AV standards – INSERT NAME HERE
Print/Photocopy/Fax Room or Location	
Wireless access points	A minimum of **two** (2) outlets shall be provided to each wireless access point.
Public / General Purpose Areas*	Outlets **shall not** be installed in these locations without written approval from Enterprise Technology **Where specific requirements are identified they shall be submitted, with supporting justification(s), to Enterprise Technology for consideration.**

*Public /General purpose areas include (but are not limited to) the following:

- Building foyer, reception and waiting areas
- Open, communal study and student recreation areas
- Retail spaces
- Courtyards
- Corridors, hallways and lift wells
- Staircases and stair landings.
- Galleries, performance and display spaces

5.1.5 Labelling

a) All cables and outlets must be labeled.
b) Labeling shall conform to AS 3085.1 Current Edition
c) All data point face plates shall be labelled with a durable traffolyte label.
d) All patch panels shall be labelled with a durable traffolyte label clearly identifying the patch panel identifier. Individual jacks shall not be labelled with their respective numbers
e) All cables shall be labeled at each end with the same identifier as the outlet it services.
f) The standard field outlet identifier shall contain the following elements:
    a. Cabling zone identifier (Room Number)
    b. Rack Identifier (R followed by a Single Digit)
    c. Patch panel identifier (A - Z) but **exclude the letters "I" and "O"** – refer to section 12.2 – Appendix B
    d. Patch panel jack identifier (1 - 24)
g) **Examples of labeling in the field**: (Refer to illustration below)
    a. 113-R1-A23 (Comms Room 113, Rack 1, Panel A, Outlet 23)
    b. G03-R1-C18 (Comms Room G03, Rack 1, Panel C, Outlet 18)
    c. B03-R3-AB16 (Comms Room B03, Rack 3, Panel AB Outlet 16)
h) Labelling in Data Centres will comply with the direction of the Manager, Data Centers and Facilities.
i) Patch panels used to terminate integrated data and voice cables shall be labeled according to this scheme with both data and voice cables sharing the same numbering sequence.

5.1.6

5.1.7 Cable Installation

a) Cable termination onto a horizontal distribution panel or patch panel shall be undertaken in a manner that permits additional cables to be terminated without unduly disturbing previously installed cables.
b) Angled patch panels shall be used. Where there is a physical limtation preventing the installtion of an angled patch panel, a flat patch panel may be used.. Where Angled panels are not used, 1 RU of horizontal cable management shall be used for each forty-eight (48) ports. The horizontal cable management panel/s shall be dimensioned to accommodate no more than twenty-four (24) patch leads.
c) All field cables shall be led through the rear verticle cable management duct prior to termination on the patch panel jack.
d) All field cables shall be terminated to a face plate as close as practically possible to the required device.
e) Field outlets shall protect the minimum bend radius of the cables entering the jack.
f) No more than twenty-four (24) cables shall be cable tied in a bunch.
g) Precautions shall be observed to eliminate cable stress caused by tension in suspended cable runs and tightly strapped bundles.
h) Cable bundles shall not rub on, or be unduly compressed against any cable tray, equipment racking, or other cable support.
i) Cable bundles shall not obstruct the installation and removal of equipment in equipment racks.
j) Where F/UTP or U/UTP cables are run parallel with electrical cables, the current AS/ACIF S009: ACMA rules for minimum separation shall be observed.
k) Where F/UTP or U/UTP cables are run in the proximity of electrical motors or transformers the minimum separation shall be one (1) metre. Separation from fluorescent lighting shall be a minimum of three hundred (300) mm.
l) Patch panels should be grouped by geographic zones for new installations

Note: All cabling shall be run in loose irregular bundles, to eliminate heat build-up that may occur when power over Ethernet (PoE) equipment is used.

In situations where the above minimum distances cannot be applied due to a lack of available space, data cables shall be enclosed in rigid and/or flexible PVC conduit. In cases where the number of data cables renders conduit impractical, PVC duct shall be used.

In cases where duct is interrupted by a wall, segregation of cables shall be maintained through the wall, and throughout all cavities between the two lengths of duct.

5.1.8 Testing

Prior to undertaking testing, all cables and outlets shall be labelled consistent with Section 5.1.5

All new or modified cabling shall be tested in its entirety according to the AS/NZS 61935-1 Class EA, permanent link configuration. All marginal passes shall be treated as a **failed** test.

Testing shall be carried out by a *certified Panduit installer* using a *Panduit approved* scanner with appropriate personality module.

Testing shall be carried out once all building electrical services are operational, service include (but are not limited to) the following:

- lighting;
- power;
- HVAC plant and;
- lift services (where applicable)

Where this is not practical, cable testing shall be carried with the maximum number of available services operational.

The cables selected for live condition testing shall be selected from all patch panels installed.

Where the installed cabling plant fails testing, the cabling installation shall be deemed incomplete, and payment withheld pending remediation,

Where testing is conducted in the absence of the complete representation of building electrical services, Enterprise Technology may request at a later date, further supplemental testing be carried out **on not less than ten percent (10%)** of the total installed cable plant **with all nominated electrical services operating**.

Where supplemental testing is requested, the cabling installation shall be deemed incomplete.

If the installed cabling plant subsequently fails supplemental testing, the cabling installation shall be deemed incomplete.

Further, UoM shall direct the contractor to re-test the installation **its entirety with all nominated electrical services operating.**

UoM reserves the right to request testing results at any juncture and the external party shall make these available, via electronic means**, no later than three (3) business days** upon receiving the request.

Where testing results are not made available the cabling installation shall be deemed incomplete, and payment withheld.

5.1.9 Testing Observation

Enterprise Technology reserves the right to observe the test procedure at any time and to perform its own tests on the cable installation.

5.1.10 Network Activation

Building network activation shall be contingent on the receipt by Enterprise Technology of satisfactory testing results.

The appointed UoM Project Manager shall provide a copy of testing results to Enterprise Technology (Network Engineer) **no less than ten (10) business days or as negotiated between the PM & Engineer** prior to the desired activation date.

In the absence of satisfactory testing results the building network **shall not be activated** without the written approval of Enterprise Technology, specifically the Manager of Network and Telephony.

5.1.11 Structured Cabling Components

Patch Panel, Cable & Outlet Specification

- Patch panels, cable and voice/data outlets shall be an integral part of a structured cabling system that is warranted by Panduit.
- "Velcro" style cable ties shall be used to secure UTP or F/UTP cables

Patch and Drop-lead Cables

- All patch and drop cables shall be Panduit certified to a **Category 6A / Class EA standard**. Patch lead part numbers can be found in Appendix C
- The maximum length of a patch or drop-lead shall be five (5) metres. Lead lengths greater than five metres shall be specifically approved by Enterprise Technology.
- Patch and drop leads shall be colour coded according to the following conventions:

Service	Colour
Data / VoIP	Blue
Data cross over	Red
Wireless (Ethernet)	Purple
Aesthetics, (for aesthetics reasons)	Typically, White.
NBN / Voice	Yellow
Serial data	Green
Fire, Security, BAS	Orange

- Patch leads are to be supplied as follows per data point installed for comms room end:

Service	Quantity	Length
Data / VoIP	1	2m
Security	1	2m
Wireless (at ceiling - white)	2	0.2m*
Wireless Access Point	1	2m

* Please confirm with wireless engineer and UoM Project Manager as lead lengths may vary according to installation requirements ie; drop poles etc

5.2 Class EA (Category 6A) Shielded Cabling Specific Requirements

5.2.1 Channel Specification

The channel shall consist of Panduit cable, patch and drop cords and connecting hardware meeting or exceeding the Class EA (Category 6A) specification according to the AS 3080 standard. Pairs shall be terminated according to the EIA/TIA T568A wiring scheme as described in the AS 3080 standard.

5.2.2 UoM Specific Requirements

All new or modifications to, structured cabling installations shall be implemented using Panduit certified **ANSI/TIA-568-C.1 Category 6A unshielded twisted pair (U/UTP) or foil shielded / unshielded twisted pair (F/UTP) to a ISO/IEC 11801 Class EA standard.**

The use of F/UTP cable shall be on an 'as-required' basis where potential EMF from nearby sources may cause interference on a U/UTP cable.

Shielding

The following table summarises the acceptable UTP shielding:

Industry acronyms	ISO/IEC 11801 Name	Cable Shielding	Pair Shielding	Preferred
UTP	U/UTP	None	None	Y
STP, ScTP, PiMF	U/FTP	None	Foil	
FTP, STP, ScTP	F/UTP	Foil	None	
STP, ScTP	S/UTP	Braiding	None	
SFTP, S-FTP, STP	SF/UTP	Braiding, foil	None	
FFTP	F/FTP	Foil	Foil	
SSTP, SFTP, STP PiMF	S/FTP	Braiding	Foil	
SSTP, SFTP	SF/FTP	Braiding, foil	Foil	

Permitted	Not Permitted

The code before the slash designates the shielding for the cable itself, while the code after the slash determines the shielding for the individual pairs:

U = unshielded
F = foil shielding
S = braided shielding (outer layer only)
TP = twisted pair
TQ = twisted pair, individual shielding in quads

5.2.3 Installation Standard

All Class EA (Category 6A) structured cable systems shall be made using products, cable and installation practices that comply with the AS ACIF S009 and AS 3080 standards.

5.2.4 Testing

Testing shall be carried out consistent with Section 5.1.8

5.2.5 Supplementary Installation Constraints

As a direct result of the critical nature of link and channel impedance compliance in a Class EA (Cat 6A), the following supplementary installation constraints are **mandatory:**

a) Structured cabling systems shall comprise certifiable cable and connectors from Panduit. This requirement is based on interoperability and warranty considerations.
b) Catenary wires shall only be used to support Class EA cables in ceiling or under-floor areas in cases where it is agreed with Enterprise Technology and that no other alternative can be used. Cables run through such areas shall be laid up on galvanized steel tray or housed in PVC duct, conduit or flexible hose.
c) A change of plane (e.g. from the vertical to the horizontal) in a tray installation shall be accomplished through the use of sections of waterfall. The same shall apply to locations where bunches of cables exit the main route and leave the tray.
d) Nylon cable ties shall not be used to bunch or secure a cable or cables. All bunching and securing shall be accomplished with Velcro style strips – maximum of 24 cables within a group.
e) Cable slack at the Floor Distributor cabling hub location shall be laid up in a Flaked figure-of-eight configuration and supported and secured with Hook and Loop type strips suspended in the vertical plane by *Velcro* strips.

5.2.6 Surface Cable Ducting

All cables shall be concealed and all data outlets mounted on the above Panduit Raceways shall be mounted on forty-five (45) degree mounting plates, e.g. Panduit Angled Face Plate.

In locations requiring the enclosure of data cables only, any of the above *Panduit R*aceway may be used with flush mounted outlets. Outlets shall be mounted external to the Panduit Raceway by the use of offset boxes.

a) Moduline Duct

Moduline cabling duct shall be used only with the written approval of Enterprise Technology. Requirements to deploy Moduline cabling must be submitted, with justification(s) to Enterprise Technology for potential approval.

In the event that Moduline duct is permitted, the following shall apply:

Moduline duct shall have a minimum depth as required to meet Panduit certification specifically in relation to minimum bend radius of the installed cable

Inside and outside right-angle bends shall be made in such a way as to accommodate the bend radius requirements of **all** of the cables to be installed

Sharp edges on covers at inside bends shall be removed and cables protected from possible sheath damage and compression

Where practical all data/voice outlets shall be mounted external to the duct space

Data outlet jacks mounted on Moduline duct shall be fitted to angled face plates e.g. Panduit Angled Face Plate.

Any cable ducting system not listed in this section shall not be installed

5.3 ISO Class E (TIA Category 6) Cabling Specific Requirements

5.3.1 Installation Restrictions

Class E (Cat6) is designated as **retired.**

Class E (Cat6) cabling **shall not be** installed on any UoM designated site.

5.4 ISO Class D (TIA Category 5/5e)

5.4.1 Installation Restrictions

Class D (Cat 5e) is designated as **retired**.Class D (Cat 5e) **shall not be** installed on any UoM designated site.

5.5 ISO Class D (TIA Category 5/5e)

5.5.1 Installation Restrictions

Class D (Cat 5e) is designated as **retired**.

Class D (Cat 5e) **shall not be** installed on any UoM designated site.

OPTICAL FIBRE CABLING

6.1 Specifications

6.1.1 Fibre Type

Cable specification shall comply with AS/NZS 3080:2013 Information Technology - Generic cabling for customer premises (ISO/IEC 11801:2011, MOD) or as specified in Site Specifications.

Fibre optic cables shall be **ISO/IEC 11801 Class OS1** cable graded for outdoor construction. Fibre optic shall be continuous end-to-end, no splices shall be permitted other than at the ends of the physical cable.

LC connectors **shall not** be used on any UoM designated sites, with the exception of UoM primary and secondary data centres.

Mechanical inline cable splices shall not be used on any UoM designated sites

6.1.2 Installation Constraints

Cable manufacturers' recommended minimum bend radii, both during and post installation shall not be exceeded. The same shall apply to all pulling forces used to install the cable.

Cable slack shall be provided as follows:

- Within a termination enclosure: half (0.5) a metre minimum

Note: the manufacturer's minimum bend radius specification shall not be exceeded in any of the above locations.

All cable installations are to include suitable patch cables as part of the installation. Patch cable length and termination type is to be determined by Enterprise Technology.

All locations of the cable run that may be accessed by service personnel are to be fitted with a laser hazard-warning label.

Enterprise Technology shall be consulted with respect to all cable route variations or for route clarification.

6.1.3 Dimensioning

Fibre optic **inter** building shall use two (2) physical fibre optics per building, each following physical diverse paths. Each fibre optic shall consist of **not less than twelve (12) cores of single mode OS1** optical cable.

Path selection and patching node nomination will be at the direction of Enterprise Technology.

Fibre optic **intra** building shall use a single physical fibre optic between building communications infrastructure. Each fibre optic shall consist of not less than twelve (12) cores of single mode OS1 optical cable.

Multimode fibre shall not be installed inter buildings.

Installations seeking to install multimode intra-building fibre must submit requirements and justification(s) to Enterprise Technology for consideration.

6.1.4 Fibre Termination

Intra building fibre cables **consisting of twenty-four (24) or less cores**, shall be terminated using USConec MTP connectors, compliant with the IEC-61754-7 standard for Multiple Push Optic (MPO) connectors.

MTP connectors shall be broken out to allow for the termination of individual core using IEC 61754-4 Simplex Connector (SCA) connectors

Intra building fibre cables **consisting of more than twenty-four (24) cores**, shall be pre-terminated or spliced again using IEC 61754-4 Simplex Connector (SCA) connectors.

6.1.5 Labelling

All cables entering and/or leaving a pit, building, riser or termination enclosure shall be fitted with a durable label in accordance with AS 3085.1 indicating the following:

- Type of cable
- Unique cable identifier (in the case of multiple cables)
- Number of cores
- Source and destination buildings

e.g. 201-193-24-2 indicates the second 24-core cable going to building No. 193 from building No. 201.

In accessible areas of the cable route, the cable and/or covers of the cable shall be labelled with appropriate hazard warning labels and affixed at 10m intervals.

6.1.6 Documentation

Document shall be prepared consistent with Section 4.2.17

In addition, fibre optic documentation shall include the following specific information:

- Cable type
- Route followed
- Pit locations (where applicable)
- Building names
- Parameter thresholds set on test equipment (including wavelength).
- "Loss Budget" calculations relating to each core
- Light Source Power Meter Link Loss
- Length measurement

6.1.7 Testing

All tests shall be carried out in accordance with AS/NZS 14763-3 and AS3080. The optical link loss budget shall be according to AS3080.

- All **single mode (SM)** cables shall be tested at 1310nm & 1550nm wavelengths in both directions using an approved light source and power meter of cable scanner fitted with optical fibre heads. OTDR tests shall be carried out with the point of injection being at both the 'A' and 'B' ends of the cable. An appropriate launch cable shall be included in all OTDR measurements.
- All **multimode (MM)** cables shall be tested at 850nm & 1300nm wavelengths in both directions using an approved light source and power meters or cable scanners fitted with optical fibre heads.

OTDR traces shall be supplied for all inter building installations. The assigned UOM Project Manager shall make such trace results available to Enterprise Technology for review.

UoM reserves the right to request OTDR testing results at any juncture and the external party shall make these available, via electronic means, no later than **three (3)** business upon receiving the request.

Where testing results are not made available the cabling installation shall be deemed incomplete, and payment withheld.

6.1.8 Patch Leading Colouring

- Yellow for OS1 (Single Mode) [1dB/km attenuation]
- Orange for OM1 (Multi Mode) [62.5/125µm]
- Aqua for OM3 (Multi Mode) [50/125µm]

6.1.9 Enclosures

All fibre cable terminations shall be made in Enterprise Technology approved wall or rack mount enclosures.

Fibre terminations for all SCA connectors shall be vertically horizontally and use Simplex connectors.

7 TELEPHONY

7.1 Specification

7.1.1 Service Provisioning

UoM has deployed a Voice over IP (VoIP) service as its main telephony delivery mechanism.

This section provides for only cabling works required for the maintenance and recovery of existing Telephone cabling.

All “telephony grade” cabling will be approved on a case by case basis at the discretion of Enterprise Technology.

Building telephone Backbone infrastructure where specified may use Cat 3 twisted pair cable, i.e. building MDF to IDF. Reticulation to the desktop shall only be made through a fully integrated Cat 5e/6 and 6A Shielded structured cabling system.

All reference in these standards to Cat. 3 is in relation to Campus Tie and Building Backbone Cabling.

Specific services shall be provided to UoM designated buildings as follows:

- Facsimile machines may be connected to either an IPTEL Analogue Gateway port extension or to NBN networks .
- All fire alarm systems shall be connected via NBN networks or mobile network technologies.
- All lift telephones shall be connected NBN networks or mobile network technologies.

Note: All costs for the above services are to be borne by the requesting department or project budget

In cases where the building MDF or IDFs are replaced/upgraded, the installing contractor shall provide the following:

- Termination of the incoming cable/s on the 'A' side of the building MDF.
- Termination of the IDF feeder cables on the 'B' side of the building MDF.
- Jumpering between the 'A' & 'B' sides of the building MDF in order to restore pre-existing telephone services and any additional services as specified in the project.

Note: All costs for the above work are to be borne by the requesting department or project budget

7.1.2 Handsets

Handsets may be purchased through the Information Technology Services - Services Desk

+ (61 3) 8344 0888

https://unimelb.service-now.com/it?id=sc_cat_item&sys_id=d6906b4d4fa73200389c66a01310c733&category_id=91f6f5134f1ec2000ecb0bd11310c7f3

Telephony handsets purchased from other sources will not be permitted

7.1.3 Cabling Installation & Alteration

Installers & Standards

All cabling work on the University Voice network shall be carried out by personnel who are" Cabling Provider Rules" registered personnel only.

All such work shall meet the minimum requirements of Australian standard AS ACIF S009.

Infrastructure Cable (Inter & Intra Building)

Underground service cables shall be specified as 0.64mm jelly filled underground telephone cable.

Internal telephone trunk cabling shall be specified as indoor grade 1/0.50 mm standard telephone cable

Cable installed between MDFs and IDFs in new installations shall provide a minimum of 25% spare capacity.

Cat 3 Applications

Cat 3 cable shall only be used in the following instances:

- Inter building trunk cabling.
- Tie cables between an MDF/IDF and a voice distribution patch panel.

Note: Cat 3 cable shall not be terminated on an RJ45 voice/data outlet (RJ45 jacks on a voice link patch panel are exempted).

Shielded Cat 6A cables shall be used in all integrated horizontal voice/data cabling instances.

Tie cables installed between a building MDF/IDF and a fully integrated Data and Voice system enclosure shall comprise Cat 3 data cable terminated on a Voice Tie patch panel. One pair of the tie cable shall be terminated on Pins 5+4 in each RJ45 jack according to the EIA/TIA T568A wiring scheme.

Splitters

The use of splitters is not permitted

7.1.4 Termination Frames

MDFs, IDFs shall be specified as *Krone* Insulation Displacement Terminating Systems employing the *LSA-PLUS* quick connection type modules.

All termination frames shall be located according to AS ACIF S009 height and working space requirements. Termination frames shall not be installed above doorways, in false ceilings or under-floor spaces.

7.1.5 Jumpering & Patching

All new jumpers shall be fed through fitted jumper rings along the jumper route and installed in a neat and tidy manner. Diagonal paths and other 'short-cuts' are not permitted. All redundant jumpers shall be removed from the terminating frame as part of the installation of new jumpers.

The following non-voice services shall be clearly identified in all distribution frames carrying such services:

Service	Plug Colour	*Krone* part No.
Fire alarm	Red	6 089 300 600
Security alarm	Green	6 089 300 602
Security camera	Green	6 089 300 602

Distribution frames using *Krone LSA-PLUS* modules shall be fitted with plastic marker plugs according to the above list.

Tag strip distribution frames shall have green or red PVC tubing placed over the tags occupied by any of the listed services. The tubing shall effectively block the attachment of test equipment to the non-voice services.

Jumpers installed on solder-tag type frames shall be soldered.

Where patch-leads are required in an integrated Data and Voice installation, yellow patch-leads shall be used. The length of the patch-lead shall be chosen to minimize excessive slack and avoid the need for shortcuts.

7.1.6 Testing

In all cases where cables are terminated or re-terminated, the contractor shall carry out the following tests:

- Polarity and Continuity
- Shorted pair
- Open circuit pair
- Crossed pair or mate

All faults detected shall be rectified before practical hand over.

The installing contractor shall guarantee a one-to-one correspondence of all colours and mates of an installed cable from end to end.

7.1.7 Documentation

In the case of new installations, record books must be provided and secured by the installation contractor at each building MDF and floor IDF. All record books shall be filled in by the installation contractor (both 'A' & 'B' sides). The 'A' side detail shall include information on the trunk cabling and the 'B' side must include the extension number or DXL number and room details.

Building MDF record books must be located and secured on site.

Tie cables installed between a building MDF/IDF and a fully integrated Data and Voice system enclosure shall be provided with a new record book at the patch panel location. The installation contractor shall provide the record book and shall fill in the 'A' - side information.

Contractors employed to install jumpers and/or patch leads shall record the 'A' and 'B' side information in all record books for that system. This requirement shall include patch panel record books where relevant. If a record book cannot be found for a specific location, a replacement book shall be obtained from the Telephone Services Coordinator. All details of the current work shall be entered into the new book.

Refer to Section 4.2.17 for general documentation requirements; floor plans showing cable route are a requirement.

8 NATIONAL BROADBAND NETWORK (NBN)

8.1 Specifications

8.1.1 Service Provisioning

The NBN is replacing the current Public Switch Telephone Network (PSTN) that currently delivers broadband data and fixed line telephony services.

This dictates that there is now a need to order a replacement NBN service plan, with a selected carrier providing the broadband data and fixed phone lines, prior to the disconnection of existing PSTN services.

8.1.2 NBN Service Types

The table below lists all PSTN service types that will be directly affected by the NBN rollout to campus buildings.

Some campus buildings have analogue lines that are not connected directly to exchanges and instead are cabled to IPTEL Analogue Voice Gateway devices – these are out of scope with respect to the transition to NBN.

PSTN Line Type	NBN Service Type
Voice	General Voice Service
Modem	General Voice Service
Fax	General Voice Service
EFTPOS	General Voice Service
Building Fire Alarm	Essential Voice Service
Emergency Lift Phone Line	Essential Voice Service
ADSL	General Data Service

8.1.3 General Voice Service

General Voice Service lines are not required to be operational during mains supply interruptions.

Service cables shall connect directly into the NBN device (NTD) if capacity is available otherwise connected into Service Providers' extender devices (NTU).

NOTE: Essential Voice Service lines take priority over available NBN device lines. The extender devices do not need to have battery backup power

- Shall be installed by a fully qualified cabling technician.
- General Voice Lines (voice, fax, modem, EFTPOS) must be cabled to NTD Voice Lines so long as they are not required by Lift Emergency Phones or Fire Alarms. Otherwise they shall be cabled to a Network Service Provider NTU.
- General Data Lines (ADSL) shall be cabled to NTD Data Lines as long as there is sufficient capacity otherwise a Service Providers' NTU must be used.

8.1.4 Essential Voice Service

Essential voice service lines are required to be operational during mains supply interruptions.

They shall be connected directly into the NBN device which must have battery backup power.

- Shall be installed by a fully qualified cabling technician.
- The Essential Service cabling between FIP Alarm Signalling Equipment (ASE) and NTD shall meet the following standards AS/CA S008, AS/CA S009 and AS/NZS 3000.
- The NTD shall have an installed battery which is replaced every two (2) years.

8.1.5 General Data Service

General Data Service lines shall not be required to operate during mains supply interruptions.

Service cables should connect directly into the NBN device (NTD) if capacity is available otherwise connected into Service Providers' extender devices (NTU). The extender devices do not need to have battery backup power.

8.1.6 Building Fire Alarm

Fire alarm lines shall continue to operate during power interruptions similarly to the fire panels which are locally battery-backed as per fire code.

NBN provides a solution whereby their NTD has battery backup power similar to Fire Indicator Panels. The battery option must be selected for buildings that contain fire panels that have existing Alarm Signalling Equipment (ASE).

NOTE: Most buildings on campus with fire panels are cabled back to a shared ASE within a different building. These buildings will not have fire alarm lines. Some buildings may have the sprinkler system contain an ASE device to send a fire alarm instead of the fire panel – this line must be treated in the same way.

- The Essential Service cable shall be directly connected into a port of the NTD and labelled 'Fire Alarm'.
- An additional NTD shall be installed if there is no capacity on the existing NTD
- The Essential Service Line must be registered with the Network Service Provider as "Fire Alarm"

8.1.7 Emergency Lift Phone

Emergency lift phones shall continue to operate during power interruptions due to confirmation that not all mobile phones will work from inside lifts – in particularly if below ground level e.g. Underground car parks.

NBN provide a solution whereby their NTD has battery backup power. The battery option shall be selected for buildings that contain lifts.

- The Essential Service cabling shall be directly connected into a port of the NTD and labelled 'Lift Phone'.
- An additional NTD shall be installed if there is no capacity on the existing NTD
- The Essential Service Line shall be registered with the Network Service Provider as Lift Emergency Phone.

8.1.8 NBN Terms & Definitions

NTD

Network Termination Device owned by NBN Co that Service Providers will provide during carrier servicescut over.

NTU

Network Termination Unit owned by Network Service Providers to extend the number of voice and data ports required in addition to those provided on the NTD.

ADSL

Asymmetric Digital Subscriber Line is a technology for transmitting digital information at a high bandwidth on existing phone lines to homes and businesses.

Network Service Provider

Wherever possible, only one Network Service Provider is permitted per building in order to minimise number of active devices.

NBN Equipment

NBNCo and carrier active equipment are to be installed in the main communications rooms of the building

Connection method for the NTD and NTU to the PSTN end point device is patching, i.e. RJ45 patch code

Tie cable from the mains Communications Room to MDF is required, if CAT3 cables are used for the PSTN end point device.

UTP links between the NBN equipment and horizontal cabling shall be provided with appropriate cable management systems.

9 WIRELESS (IEEE 802.11) COMMUNICATIONS INFRASTRUCTURE

9.1 Service Context

9.1.1 Background

UoM operates multiple discrete wireless data and telephony networks based on the IEEE 802.11 family of standards (herein 'WiFi').

These Standards define the physical installation of wireless access points (WAPs) into UoM designated sites and buildings to support wireless connectivity for data and telephony services.

9.1.2 Wireless Spectrum

The designated spectrum for wireless network installation is the 5Ghz bands. Operation of devices using the 2.4Ghz bands is depreciated. **Device using these bands shall not be deployed into UoM designed sites and locations with the written approval of Enterprise Technology**

9.1.3 Compliance

All wireless access points deployed at UoM must comply with the following ACMA regulations:

- Radio communications (Data Transmission Equipment Using Spread Spectrum Modulation Techniques) Standard 2003
- Radio communications (Short Range Devices) Standard 2004

9.1.4 Wireless Service

The provision of wireless networking on UoM campuses is designated as an essential infrastructure service; consistent availability and ubiquitous coverage is a required across all UoM designated sites.

Of particular criticality is the use of wireless telephony services.

9.1.5 Locating Access Points

Placement of access points, both indoor and outdoor, shall be at the direction of Enterprise Technology. Placement will be based upon radiometric considerations, designed to deliver optimal service quality to end users.

External parties and/or contractors shall not place access points without the explicit, written direction of Enterprise Technology.

Where conflicts arise between the placement of wireless access points and aesthetical considerations, wireless networking service quality and availability shall take precedent.

9.2 General Specifications

9.2.1 General Specifications

- Indoor access points shall be placed such that the lower antenna surface of the access point is **at least fifty (50) millimetres below the lowest** ceiling obstruction, including lighting fixtures.
- Indoor access points shall be mounted to or from the building ceiling in a horizontal plane / orientation
- Indoor access points shall **not** be mounted to walls without the written approval of Enterprise Technology.
- Indoor and outdoor access points shall be mounted to surfaces using only vendor approved brackets.
- All access points shall be provided a minimum of two (2) Category 6A (Class EA) F/UTP cables. Two (2) drop leads also supplied.

9.3 Mounting Specifications

This section defines the manner in which access points supporting wireless services shall be physically mounted to building surfaces:

9.3.1 Indoor Access Points

a) UoM deploys one model of indoor access point for indoor coverage:
   a. **Cisco C9130AXI (226 x 226 x 48 mm / 1.45 kg)**
   b. **Cisco C9130AXE (233 x 233 x 40 mm / 1.71 kg)**

b) There are a range of brackets available for different ceiling types. The following specifications define mounting within UoM buildings:

c) Exposed Concrete Slab Ceilings

a. While Mounting internal AP's on exposed concrete ceilings threaded rods can be used. Refer to Appendix C
b. Access points shall be mounted fifty (50) millimetres below the lowest ceiling obstruction, as per Section 9.2.1
c. Where the ceiling is free of obstructions, such as, but not limited to, air conditioning ducts, cable trays, pipework and lighting fixtures then access points shall be mounted directly to the ceiling using the following bracket:
   i. Cisco AIR-AP-BRACKET-1
d. For external Access points shall be mounted on a horizontal plane with the antenna lower surface parallel to the floor surface.
e. Where ceiling obstructions are determined to have a deleterious effect upon service quality, access points shall be mounted to a mounting pole which itself is then fixed to the ceiling.
f. Access points shall be fixed to the mounting pole using the following bracket:
   i. Cisco AIR-AP-BRACKET-1
g. The mounting rods must be of sufficient length to ensure the lower surface of the AP is fifty (50) millimetres below the lowest ceiling obstruction, as per Section 1.1.77.
h. Mounting threaded rods shall be constructed and fixed to support a weight of no less than seven and half (7.5) kilograms, in addition to its own weight.
i. Two (2) port MUTO's shall be fixed to the ceiling in close proximity (< 100mm) to the fixing point of the mounting pole and supporting cabling fed inside the pole down to the access point.
j. Cabling shall not be fixed or tied to the outer surface of the mounting points.
k. Mounting rods are to be painted in a colour consistent with that used for the ceiling.
l. Appendix C provides a visual reference for the mounting of access points using threaded rods.
m. Appendix D shows the visual reference for mounting the access points and antennas using mounting poles.

d) Plaster Ceilings

a. Access points shall be mounted fifty (50) millimetres below the lowest ceiling obstruction, as per Section 9.2.1
b. Where the ceiling is free of obstructions, such as, but not limited to, air conditioning ducts, cable tray, pipework and lighting fixtures then access points shall be mounted directly to the ceiling using the following bracket:
   a. **Cisco AIR-AP-BRACKET-1**
c. Brackets supporting access points shall be fixed to a ceiling joist with a minimum of two (2) anchor points. Fixing of the bracket shall be done to support weights of a maximum of five (5) kg.
d. Where the designated position of the access point cannot accommodate the minimal number of anchor points the following will apply:

i. Submission shall be made to Enterprise Technology to move the AP to a position which fulfils anchoring requirements, based of consideration to the wireless service impacts.
ii. Where reposition cannot be accommodated without deleterious effects upon service quality, additional timber formwork, within the ceiling cavity, shall be required to provide sufficient anchoring.

e. Brackets shall **not** be fixed solely into plasterboard.
f. MUTOs shall be mounted into the ceiling cavity and fixed to either a ceiling joist, strutting beam or rafter and within six hundred (600mm) of the egress point through the plasterboard to the access point.
g. Where a plaster ceiling has been hung in a manner in which it is not parallel to the floor surface, mounting poles shall be use such that the access point's lower antenna surface is in a horizontal plane, parallel with the floor surface.

e) False & Suspended Ceilings

a. Access points shall be mounted to ceiling channel rails using one of the following two brackets:
b. Where the ceiling tile is recessed:
    1. **Cisco AIR-AP-T-RAIL-R**
c. Where the ceiling tile is flush mounted:
    1. Cisco AIR-AP-T-RAIL-F
d. The above brackets shall be mounted to the following channel adaptor:
    1. Cisco AIR-CHNL-ADAPTER
e. The channel adapter slides on to the railing system to provide enhanced distribution of weight across the railing
f. Access points shall not be mounted to ceiling tiles directly
g. Access points shall not be mounted / installed within the ceiling cavity
h. Minimum heights below ceiling obstructions, as per Section 9.2.1, shall be observed.
i. Where mounting poles are installed it must be accordance with specifications for 'Exposed Concrete Slab Ceilings' above
j. MUTOs shall be installed into the ceiling cavity and located within a maximum of six hundred (600mm) millimetres of the egress point through the tile to the access point.
k. Appendix B provides a visual reference for the mounting of access points to false and suspended ceilings.

f) Exposed Timber / Steam Beam (Trussed) Ceiling

a. Access points shall be mounted fifty (50) millimetres below the lowest ceiling obstruction, as per Section 9.2.1
b. Where the ceiling is free of obstructions, such as, but not limited to, air conditioning ducts, cable tray, pipework and lighting fixtures then access points shall be mounted directly to lower, floor facing surface of roofing trusses using the following bracket:
    i. Cisco AIR-AP-BRACKET-1
c. Access points shall be mounted on a horizontal plane with its lower surface parallel to the floor.
d. Where the access point cannot be mounted to a truss consistent with the) above, the access point shall be attached to a mounting pole in accordance with specifications for 'Exposed Concrete Slab Ceilings' above.

g) **Wall Mounting**

a. Where space, material or other constraints exists access points may be mounted to an internal wall.
b. Access points shall be mounted to the wall using the following right-angle bracket:
    i. **Oberon Wireless 1011-00-WH**
c. Access points shall be mounted at a height that places the lower antenna surface of the access point fifty (50) millimeters below the lowest ceiling mounted obstructions.
d. Access points and mounted brackets are to be installed consistent with manufactures' directions and guidelines

h) **Wall Mounting in lecture theatres**

a. Access points shall be mounted to the walls with directional antennas as specified in the design and SoW using the Cisco or Ventav brackets. Access points shall be mounted to the wall or ceiling using Antenna Wall Mount Cisco or Ventav brackets
    i. AIR-**AP-BRACKET-9=**
    ii. **Ventev TW-COLOMOUNT-MULT mounting brackets**
b. Access points and mounted brackets are to be installed consistent with manufactures' directions and guidelines
c. Please refer to Appendix C shows the visual reference for mounting the access points and antennas to the wall
d. For detailed instructions on building the AP with antennas on the Oberon bracket can refereed in the below location. https://www.anixter.com/en_us/products/1013-COVER/OBERON/Zone-Cabling-and-Wireless-Enclosures/p/644173?timeout=true

9.3.2 Outdoor Access Points

UoM deploys five models of outdoor access point for coverage:

Cisco AIR-AP1562i (229 x 171 x 98 mm / 2.5 kg)

Cisco AIR-AP1562d (229 x 171 x 109 mm / 2.6 kg)

Cisco AIR-AP1562e (229 x 171 x 98 mm / 2.5 kg)

Cisco AIR-AP1572EAC (300 x 201 x 201mm / 6.1kg)

Cisco AIR-AP3802e (220 x 220 x 62.5 mm / 2.09 kg)

Cisco C9130AXE (233 x 233 x 40 mm / 1.71 kg)

As each of the above access points are associated with numerous different mounting methods, mounting of such devices shall be performed in consultation with Technology Services.

The third-party contractor is directed to consult the following documents which provide guidance in terms of the installation of the access points listed above

https://www.cisco.com/c/en/us/td/docs/wireless/access_point/1560/installation/guide/1560hig/1560_ch2.html#49751

https://www.cisco.com/c/en/us/td/docs/wireless/access_point/1570/installation/guide/1570hig.pdf

Technology Services shall provide guidance as to the following:

- Physical location for outdoor access points
- Mounting method
- Cisco part numbers (where required) for mounting brackets to match selected mounting method.
- Provisioning of Ethernet connectivity to support communications backhaul
- Provisioning of AC power to the access point.

The UOM project manager shall be responsible for liaising with Enterprise Technology to ensure the above criteria are agreed and documented prior to physical installation.

No outdoor access points shall be installed without the prior written approval of Enterprise Technology

9.3.3 Outdoor Antennas

In some circumstances UoM may elect to install standalone panel antennas for the AP1562e, AP9130AXE model of AP.

Only 5 models are certified for use on UoM designed sites:

C-ANT9103 - 1.13 kg

C-ANT9102= 1.04 kg

AIR-ANT2513P4M-N= 2.3 kg

AIR-ANT2566D4M-R= 1.43 kg

AIR-ANT2566P4W= 1.25 kg

Third party contractors shall comply with the installation requirements set out in the following document for both pole and wall mounting methods:

https://www.cisco.com/c/en/us/td/docs/wireless/antenna/installation/guide/ant2588p3m-n.html

https://www.cisco.com/c/en/us/td/docs/wireless/antenna/installation/guide/ant2513p4mn.html

No outdoor antennas shall be installed without the prior written approval of Enterprise Technology

9.3.4 Heritage Considerations

Destructive or intrusive activities with UoM designated sites must comply with heritage considerations as detailed in Section 4.2.6.

9.3.5 Colouring

All access points ship with a default finishing of white. In certain circumstances, for aesthetical reasons, a vanity cover may be attached to the surface of the access point to alter its appearance.

Covers shall be sourced from Oberon Wireless and are available in the following colours:

- Black
- Dark Grey
- Light Grey
- Tan
- Navy Blue

Covers shall only be used with the written approval of Enterprise Technology.

Requirements and justification(s) for the use

9.3.6 Site Inspection

Qualified engineers from Enterprise Technology shall conduct no less than three (3) site inspections. During all inspections, a suitably briefed external party / contractor shall be on site. In addition, the appointed UOM project manager shall also be present.

Inspections defined as follows:

Initial Site Inspection

The engineer shall inspect the site and discuss with the contractor representative the considerations for the placement of all access points. These shall be based on radiometric modelling performed using building plans and/or drawings.

Radiometric surveys may be undertaken by the engineer at this point to further refine the precise placement of access points; within. the length limitations of the cables installed.

In-progress (rough in) Inspection

The engineer shall attend the site in conjunction with the contractor representative immediately prior to 'rough-in' of data cabling to confirm the correct intended placement access-points and supporting MUTOs.

Completion Inspection

The engineer shall inspect the physical placement of all access points for consistency against this standard.

Where the installation of access points does not conform with the specifications defined in this Standard the cabling installation shall be deemed incomplete, and payment withheld.

The engineer shall also conduct radiometric a survey to ensure service quality meets minimal acceptable criteria.

9.3.7 Network Activation

The completion inspection shall be conducted no later than ten (10) business days prior to the desired network activation date.

Where the completion inspection deems the installation inconsistent with the Standard, or where minimal service criteria are not met, network activation shall not occur without the written approval of Enterprise Technology.

Minimal service quality criteria are defined in Appendix 3 of this Standard

10 SMART CAMPUS INFRASTRUCTURE

10.1 General Specifications

10.1.1 Background

UoM maintains and operates infrastructure to realise a 'Smart Campus' capability. In essence, this means an ability to insert sensors and actuators into the campus fabric, for the purposes of acquiring data, associated with a range of measurable phenomena, as well as controlling campus assets.

10.1.2 Compliance

All cabling works associated with Smart Campus infrastructure must be installed consistent with Sections 4 and 5 of this document

10.2 Space Utilisation

10.2.1 Background

For the purposes of optimising the utilisation of built spaces on UoM campus, the University gathers data relating the building and floor occupancy levels during each day. Specific hardware is deployed at a building and floor level and connected to the University's Smart Campus infrastructure.

The University employs two discrete technologies when assessing space utilisation, both of which are predicated on video streams and image recognition.

- **Xovis counters** use a downward facing camera above room exit and entry points (doorways), to detect and count people
- **Steinel counters** are mounted in a room corner and take an image of the entire space to detect and count occupants.

10.2.2 Approach Selection

Generally, the approach using the downward facing Xovis cameras is applied to larger teaching spaces and areas with multiple floors and exit/entry points.

The Steinel solution using a whole room image, to count occupants, is only functional within a 10m radius of the camera mounting point, and is therefore limited and the preferred option for small teaching and tutorial rooms

The technology selection, and consequently the positioning of Ethernet outlets, is dependent on the area and dimensions of the space under consideration.

Steintel solution must be deployed for small teaching and tutorial rooms, with a single doorway, where all seating areas can be imaged by a camera mounted in one of the four corners of the space, noting the 10m effective radius, the must be employed.

Where the area is *marginally* larger such that it cannot be covered by a single Steinel camera, a second unit may be installed in one of the remaining corners to ensure coverage of all seating areas

All other spaces should use the downward facing entry/exit cameras from Xovis.

The Xovis and Steintel system must never be combined or deployed together into a single discrete space. Each space must use only one of the two supported solutions.

10.2.3 Outlet Placement: Steinel

Sections 10.2.3 and 10.2.4 relate to outlet placement supporting the Steinel room cameras.

One (1) UTP outlet must be place in the corner of space which will afford the mounted camera the clearest at least obstructed view of all the area's seating. The camera will be mounted in the top of the corner close to the ceiling, and therefore the outlet must be placed in close proximity to this position, such that (i); it reduces the length of any path cabling required and; (ii) does not hinder or inhibit the moulting of the camera nor its field of view.

The selection of the outlet position must take into consideration the 10m effective radius of the camera's field of view and ensure it affords coverage of the requisite seating areas.

Detailed deployment examples can be found in Section 12.6 of this document.

10.2.4 Glass Walls & Panels

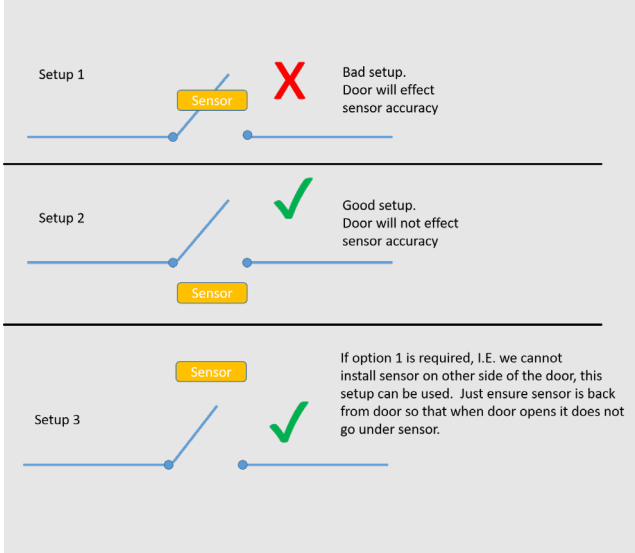
As the Steintel solution uses image based recognition, rooms and spaces bordered or walled using transparent materials, such as glass, pose a challenge, since individuals in adjoining spaces may inadvertently be counted.

Care and consideration must be taken when selecting the room corner in which the camera will be mounted, to minimise the chances of the system incorrectly counting individuals from outside the space under consideration.

10.2.5 Outlet Placement: Xovis

Sections 10.2.5 to 10.2.9 relate specifically to the placement of outlets supporting the Xovis downward facing cameras above room doorways.

Outlets should be places as centrally as possible above entry/exit points. They must be set back a sufficient distance from doorways such that the opening and closing of doors does not interfere with the sensor operation nor physically hit the sensor:



10.2.6 Total Building Occupancy

One (1) UTP outlet must be installed above every external entry/exit point into a building. Outlets must be placed on the internal (indoor) side of all door and hallways providing external access to and from a building.

10.2.7 Floor Occupancy

One (1) UTP outlet must be installed above every discrete entry/exit point on each floor. This includes, but is not limited to:

- Entry/Exit doorways
- Lift doors
- Door leading to stairwells

10.2.8 Lifts

For banks of lifts it may not be necessary to have a discrete sensor above each set of lift doors. An assessment of lift wells should be made to determine the minimum number of sensors required to capture all foot traffic entering and exiting the lift area. Refer to 10.2.9 below for additional direction.

10.2.9 Large entry ways

The counting sensors are cable of measuring within a total overall sectional length of 2.7m.

Where the width of the entry/exit point to a building or floor space, including sets of lift wells, exceeds 2.7m then UTP outlets must be placed at intervals such that are located at the centre of each 2.7m span.

By way of example:

Total entry width: ***3.2m***

Number of counters required: ***3.2m / 2.7m = (1.185) = 2 devices***

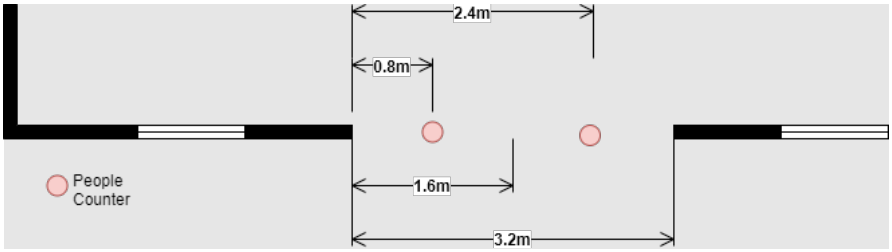
Calculate width to be covered by each sensor (total span / # of sensors): ***3.2 /2 = 1.6m***

Calculate mid-way point of span width: ***1.6/2 = 0.8m***

Derive sensor placement from left to right:

Sensor #1: 0.8m *from left-hand edge of entry*

Sensor #2: 2.4m *from left-hand edge of entry*



10.3 Time Displays

10.3.1 Background

To facilitate the coordinated updating of campus clocks at the transitions of daylights savings, UoM maintain network attached time displays.

10.3.2 Teaching Spaces

One (1) UTP outlet must be installed on to a wall and at a sufficient height, such that it is visible from all intended seating positions within the space as well as from the area intended for those delivering the teaching content

The outlet must be placed at a height where cannot be accessed unless the use of a ladder or similar is employed. If this cannot be achieved, owing to the ceiling height of the space, it must be referred to Enterprise Technology for review and written approval.

10.3.3 Secure Office Spaces

One (1) UTP outlet must be installed on to a wall and at a sufficient height, such that it is visible to the majority of occupants within the space.

10.3.4 Public Accessible Areas

One (1) UTP outlet must be installed on to a wall and at a sufficient height, such that it is visible to the majority of occupants within the space.

The outlet must be placed at a height where cannot be accessed unless the use of a ladder or similar is employed. If this cannot be achieved, owing to the ceiling height of the space, it must be referred to Enterprise Technology for review and written approval.

11 INTER BUILDING RADIO LINKS

11.1 Specifications

11.1.1 General Guidelines

Radio based links may be used to provided intra building and inter site connectivity. Generally, these are of a temporary or short-term nature, and permanent site connectivity provisioned on radio-based links is strongly discouraged.

The following guidelines shall apply:

- The preferred method of connectivity remains physical cable in the following order of preference:
    1. UoM owned fibre
    2. VERNet fibre
    3. Carrier service
- In certain circumstances the availability and costs considerations for the above services may dictate alternative methods of connectivity, specifically:
    - Building lease period does not warrant significant investment in fixed infrastructure.
    - A lack UoM or VERNet fibre in proximity to the building.
    - Provisioning of UoM or VERNet fibre is cost prohibitive
    - OPEX associated with a carrier service can be avoided via use of a radio link
    - Required site-to-site connectivity extends only for a relatively short geographical distance.
- Radio link shall not be used for intra building connectivity.

11.1.2 Frequency Considerations

Radio hardware may operate in either the unlicensed ISM bands or licensed radio communication bands.

Where licensed bands are employed the UOMUoM project manager is responsible for ensuring the appropriate license is obtained from the Australian Communications & Media Authority (ACMA).

Infrastructure Services Enterprise Technology is responsible for maintaining license currency once the service has been commissioned.

11.1.3 Deployment Procedure

The following procedure shall apply to all radio links:

a) Requirements and justification(s) for radio-based connectivity is submitted by the UOM project manager to Enterprise Technology, specifically the Manager of Network & Telephony for consideration. Submissions shall include costings demonstrating why preferred connectivity methods cannot be deployed.
b) The UOM project manager shall secure from a remote site administrator the following:
    a. A statement covering the legal right of UoM to occupy such space(s) as set out in the associated design document
    b. Agreement as to the proposed scope of works
    c. Guidance as to specific OH&S and induction requirements associated with access to the remote site
c) The C-P& D project manager shall obtain a design certificate from an accredited structural and/or civil engineer.
    a. The certificate shall warrant the following:
    b. The structural integrity of the completed antenna and support system. When completed in accordance with the engineer's documented design and job instructions, the system shall be structurally adequate.
    c. Compliance of the structure(s) with current Australian Standards covering loading, wind force and steel and concrete structures.
    d. Compliance with the Building Amendment Act and the Building Code of Australia. Construction Drawings Engineering drawings clearly and accurately depicting all fabrications fixings and fasteners that are a part of the installation shall be provided.
d) Where a third-party supplier is engaged they shall provide to both the C-P & D project manager and Enterprise Technology an artefact that addresses the following:
    a. Design schematic depicting all major components, associated radio frequencies and management demarcation points.
    b. Statement of compliance with respect to State and Federal communications legislation.
    c. Agreed service level agreements (SLAs)
    d. Service provider contact information.

No site works shall commence until the above four (4) criteria have been met.

12 APPENDICES

12.1 Appendix A – Standard Rack Layouts

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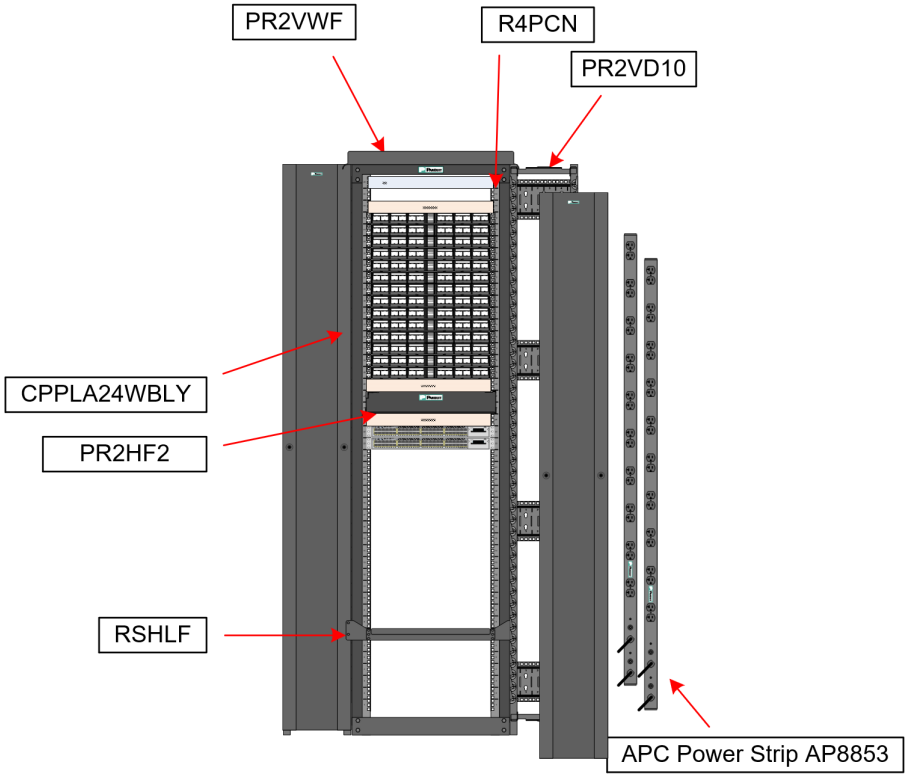
Rack Standard for Communication Rooms – Comms-1R-LD-A
1 Rack, Low density Cabling, Max 336 Live Connections

THE UNIVERSITY OF MELBOURNE



Minimum Recommended for rooms with 1 Rack

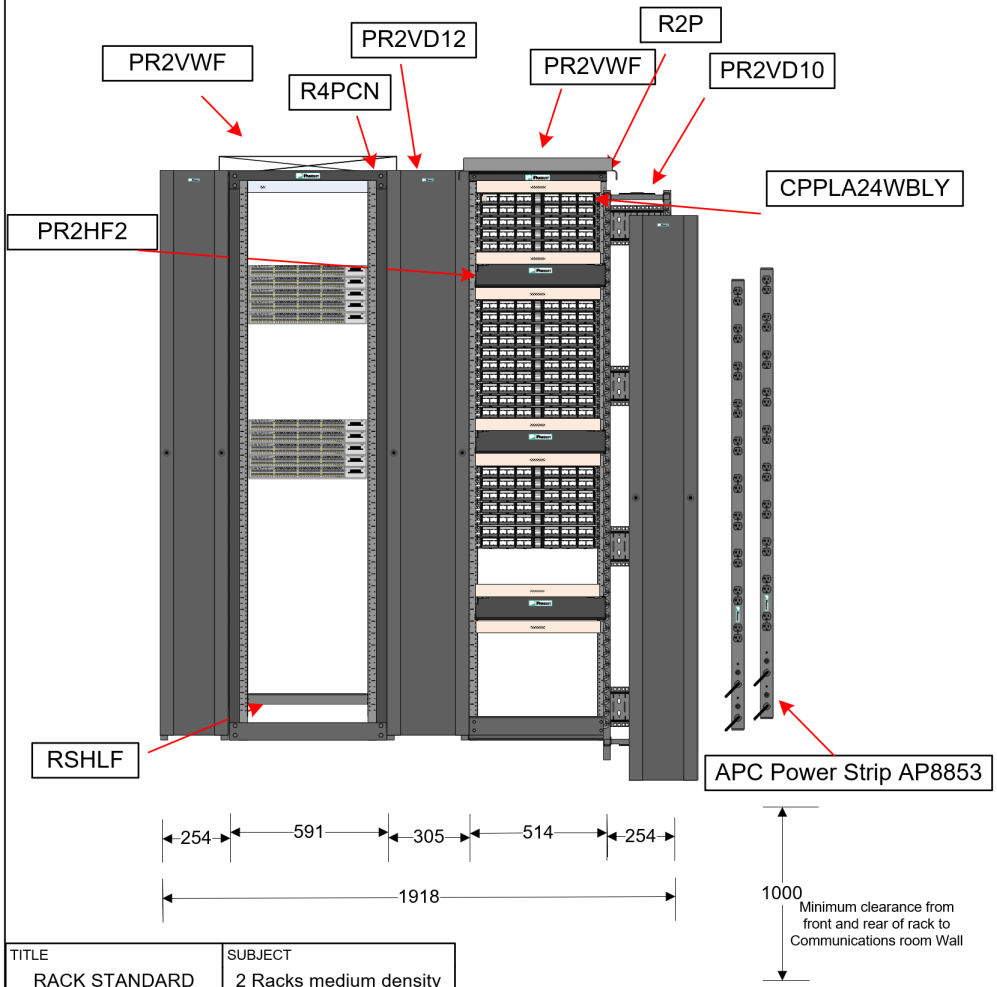
Part Number	Quantity	Description
R4PCN	1	Rack 4 Post, 45 RU
PR2VD10	2	Vertical cable manager (599 Cat6A)
PR2VWF	1	Top trough with waterfall for 4 post rack
RSHLF	1	Shelf for 4 post rack
PR2HF2	1	Horizontal manager with cover
CPPLA24WBLY	As required	Angled modular patch panel
Power Strip	2	APC AP8853 (Conversion required)

Footprint Area
2134mmH x 1099mmW x 1067mmD

TITLE	SUBJECT		
RACK STANDARD	1 Rack low density		
Created	Drawn by	Last updated	Last update by
10 May 2022, 16:05	SERGIO VALQUI	10 May 2022, 21:05	MIHAIL BORUNTIA
FULL FILENAME			PAGE
Z:\STANDARDS\UOM-IS-CS-NETWORKS-STANDARDSFORRACK-REV5.0.VSD			2 OF 9

Rack Standard for Communication Rooms – Comms-2R-MD-A
2 Racks, Medium Density Cabling Max 528 Live Connections

THE UNIVERSITY OF MELBOURNE



Minimum Recommended for rooms with 2 Racks

Part Number	Quantity	Description
R4PCN	1	Rack 4 Post, 45 RU
R2P	1	Rack 2 Post, 45 RU
PR2VD12	1	Vertical cable manager (728 Cat6A)
PR2VD10	2	Vertical cable manager (599 Cat6A)
PR2VWF	1	Top trough with waterfall - 4 post rack
PR2VWF	1	Top trough with waterfall - 2 post rack
CPPLA24WBLY	As required	Angled modular patch panel
RSHLF	1	Shelf for 4 post rack
PR2HF2	3	Horizontal manager with cover
Power Strip	2	APC AP8853 (Conversion required)

Footprint Area
2134mmH x 1918mmW x 1067mmD

TITLE	SUBJECT		
RACK STANDARD	2 Racks medium density		
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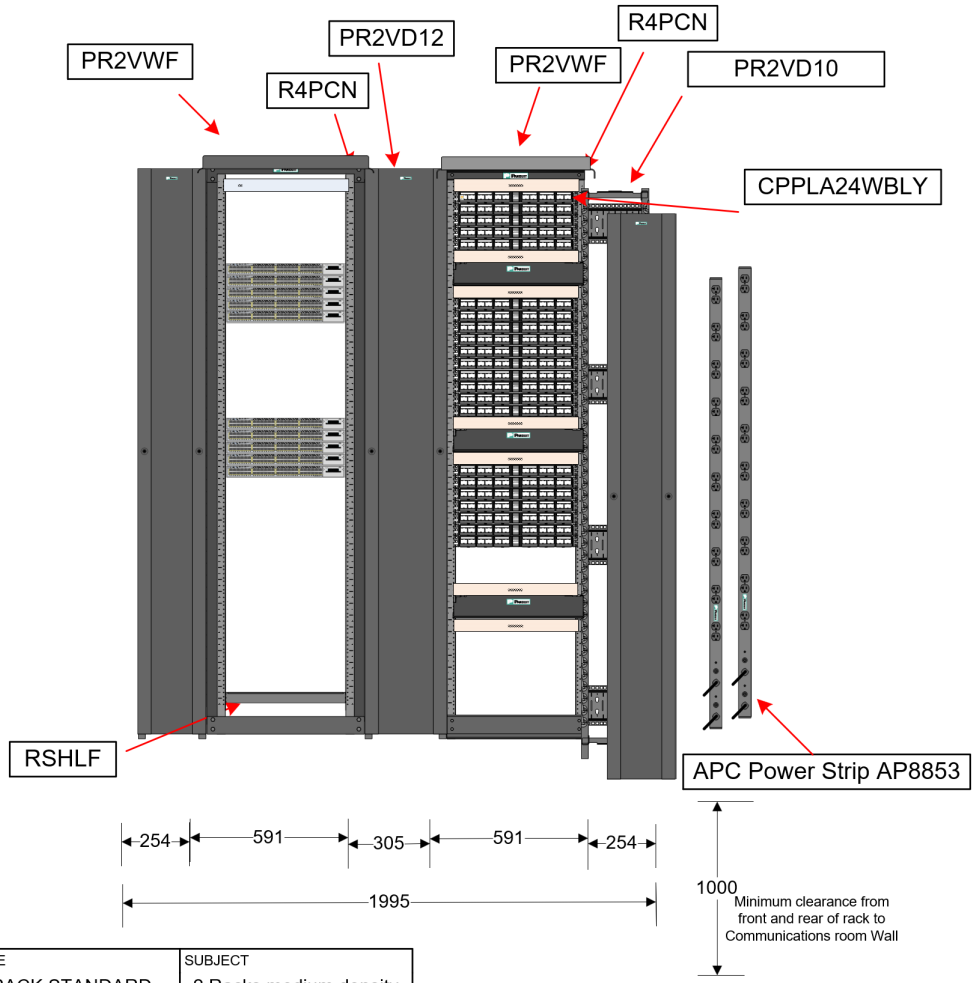
Rack Standard for Communication Rooms – Comms-2R-MD-B
2 Racks, Medium Density Cabling Max 672 Live Connections

THE UNIVERSITY OF MELBOURNE



Minimum Recommended for rooms with 2 Racks

Part Number	Quantity	Description
R4PCN	2	Rack 4 Post, 45 RU
PR2VD12	1	Vertical cable manager (728 Cat6A)
PR2VD10	2	Vertical cable manager (599 Cat6A)
PR2VWF	2	Top trough with waterfall - 4 post rack
RSHLF	1	Shelf for 4 post rack
CPPLA24WBLY	As required	Angled modular patch panel
PR2HF2	3	Horizontal manager with cover
Power Strip	2	APC AP8853 (Conversion required)

Footprint Area
2134mmH x 1995mmW x 1067mmD

TITLE	SUBJECT		
RACK STANDARD	2 Racks medium density		
Created	Drawn by	Last updated	Last update by
10 May 2022, 16:05	SERGIO VALQUI	10 May 2022, 21:05	MIHAIL BORUNTIA
FULL FILENAME			PAGE
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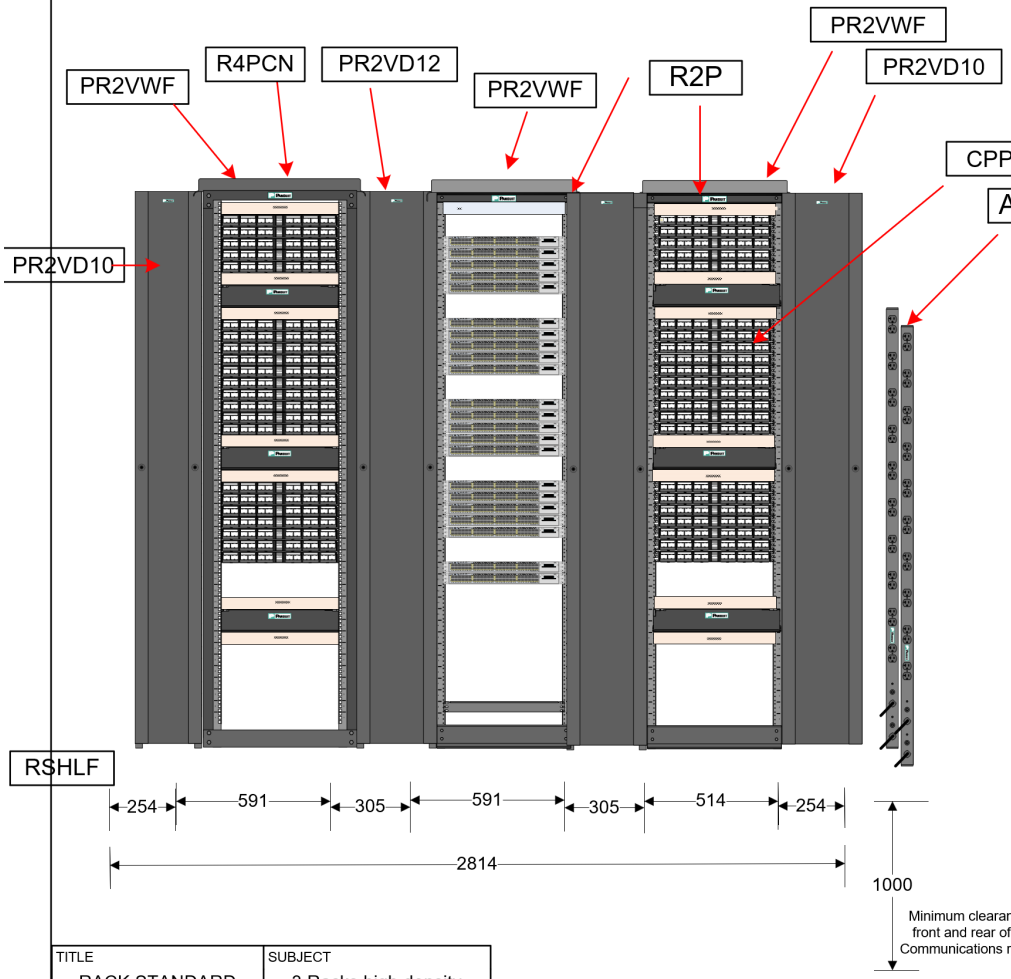
Rack Standard for Communication Rooms – Comms-3R-HD-A
3 Racks, High Density Cabling Max 1056 Live connections

THE UNIVERSITY OF MELBOURNE



Minimum Recommended for rooms with 3 Racks

Part Number	Quantity	Description
R4PCN	2	Rack 4 Post, 45 RU
R2P	1	Rack 2 Post, 45 RU
PR2VD12	2	Vertical cable manager (728 Cat6A)
PR2VD10	2	Vertical cable manager (599 Cat6A)
PR2VWF	2	Top trough with waterfall for 4 post rack
PR2VWF	1	Top trough with waterfall for 2 post rack
PR2HF2	6	Horizontal manager with cover (132 Cat6A)
RSHLF	2	Shelf for 4 post rack
CPPLA24WBLY	As required	Angled modular patch panel
Power Strip	2	APC AP8853 (Conversion required)

Footprint Area
2134mmH x 2814mmW x 1067mmD

TITLE	SUBJECT		
RACK STANDARD	3 Racks high density		
Created	Drawn by	Last updated	Last update by
10 May 2022, 16:05	SERGIO VALQUI	10 May 2022, 21:05	MIHAIL BORUNTIA
FULL FILENAME			PAGE
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Rack Standard for Communication Rooms – Comms-4R-HD-A
4 Racks, High Density Cabling Max 1872 Live connections

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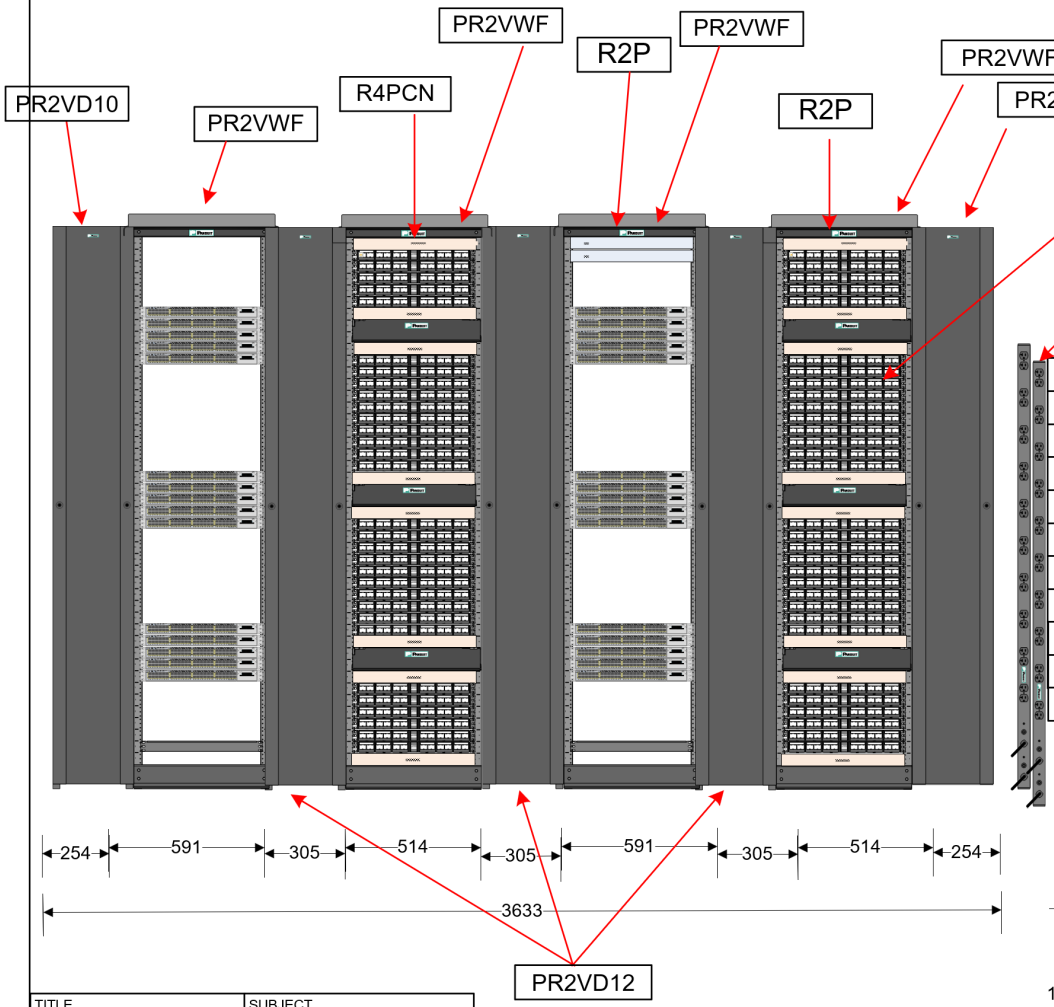

Minimum Recommended for rooms with 4 Racks

Part Number	Quantity	Description
R4PCN	2	Rack 4 Post, 45 RU
R2P	2	Rack 2 Post, 45 RU
PR2VD12	3	Vertical cable manager (728 Cat6A)
PR2VD10	2	Vertical cable manager (599 Cat6A)
PR2VWF	2	Top trough with waterfall – 2 post
PR2VWF	2	Top trough with waterfall for 4 post rack
PR2HF2	6	Horizontal manager with cover
RSHLF	2	Shelf for 4 post rack
CPPLA24WBLY	As required	Angled modular patch panel
Power Strip	4	APC AP8853 (Conversion required)

Footprint Area
2134mmH x 3633mmW x 1067mmD

TITLE	SUBJECT		
RACK STANDARD	4 Racks high density		
Created	Drawn by	Last updated	Last update by
10 May 2022, 16:05	SERGIO VALQUI	10 May 2022, 21:05	MIHAIL BORUNTIA
FULL FILENAME			PAGE
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Rack Standard for Communication Rooms – Coms-1R-LD-Cabinet
Low Density Cabling, Max192 Live Connections
Open Spaces

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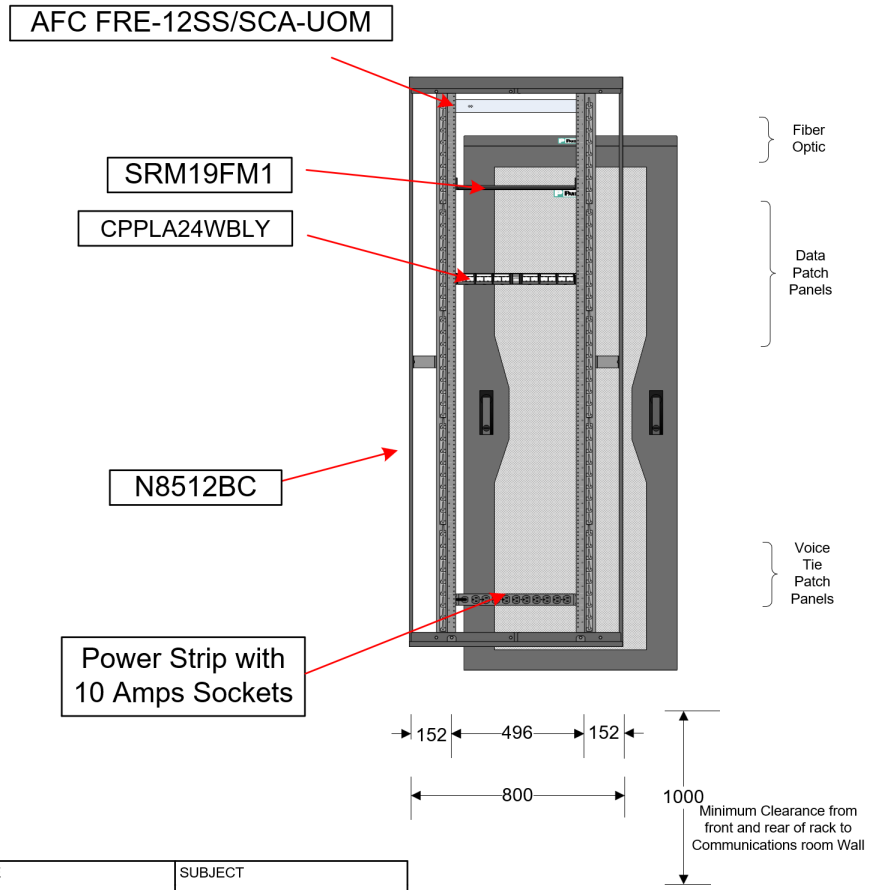

Minimum Recomended

Part Number	Quantity	Description
N8512BC	1	Panduit Net-Access Switch Cabinet
FRE-12S/SCA-UOM	As required	1RU Fibre Enclosure 12FO Outdoor
CPPLA24WBLY	As required	Angled modular patch panel
SRM19FM1	1	Shelf for 2 post rack
AP7821B	1	APC 16A Power Strip with 10A Sockets

Footprint Area
2134mm H x 800mm W x 1044mm D

TITLE	SUBJECT		
RACK STANDARD	1 Rack low density		
Created	Drawn by	Last updated	Last update by
10 May 2022, 16:05	SERGIO VALQUI	10 May 2022, 21:05	Mihail Boruntia
FULL FILENAME			PAGE
Z:\STANDARDS\UOM-IS-CS-NETWORKS-STANDARDSFORRACK-REV5.0.VSD			7 OF 9

Rack Standard for Communication Cabinet – Comms-1WMC-LD
1 Wall Mount Cabinet, Low Density Cabling
Unsecured Open Space

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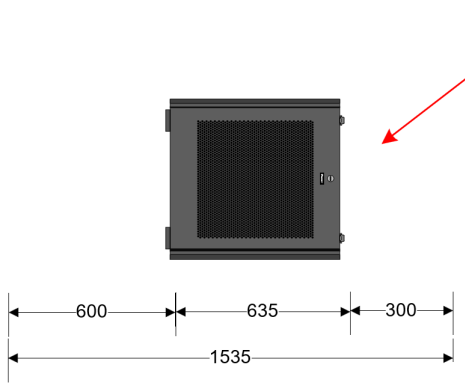

Minimum Recomended

Part Number	Quantity	Description
PZWMC1230P	1	12RU Wall Mount Cabinet
CPPLA24WBLY	As required	Patch panel with labels
WMPFSE	As required	Horizontal manager with cover
AP7821B	2	APC 16A Power Strip with 10A Sockets

TITLE	SUBJECT		
RACK STANDARD	1 Rack low density		
Created	Drawn by	Last updated	Last update by
10 May 2022, 16:05	SERGIO VALQUI	10 May 2022, 21:05	Mihail Boruntia
FULL FILENAME			PAGE
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Rack Standard for Communication Cabinet – Comms-1VC-LD
1 Wall Mount Vertical Cabinet, Low Density Cabling
Unsecured Open/Shared Spaces (limited Space)

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Minimum Recomended

Part Number	Quantity	Description
WME3BL	1	6 RU Enclosure
CPP24FMWBLY	As required	Patch panel with labels

TITLE	SUBJECT		
RACK STANDARD	1 Cabinet Low Density		
Created	Drawn by	Last updated	Last update by
20 March 2022	Parag Waghmare	10 May 2022, 21:05	Mihail Boruntia
FULL FILENAME			PAGE
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12.2 Appendix B – Rack RU labelling

Rack RU (45 at Top)	Patch Panel Label	Rack RU (1 at top)
45	A	1
44	B	2
43	C	3
42	D	4
41	E	5
40	F	6
39	G	7
38	H	8
37	J	9
36	K	10
35	L	11
34	M	12
33	N	13
32	P	14
31	Q	15
30	R	16
29	S	17
28	T	18
27	U	19
26	V	20
25	W	21
24	X	22
23	Y	23
22	Z	24
21	AA	25
20	AB	26
19	AC	27
18	AD	28
17	AE	29
16	AF	30
15	AG	31
14	AH	32
13	AJ	33
12	AK	34
11	AL	35
10	AM	36
9	AN	37
8	AP	38
7	AQ	39
6	AR	40
5	AS	41
4	AT	42
3	AU	43
2	AV	44
1	AW	45

12.3 Appendix C – Bills of Materials

Single Mode (OS1) Inter Building Cables

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12SS/SCA-UOM-1	1RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 1 X 12 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING 12 X SCA SIMPLEX THROUGH ADATPERS 12 X SCA PIGTAILS 12 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-24SS/SCA-UOM-1	1RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 2 X 12 FIBRE SINGLE MODE CABLE OR 1 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 24 X SCA SIMPLEX THROUGH ADATPER S 24 X SCA PIGTAILS 24 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-24SS/SCA-UOM-2	1RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 2 X 12 FIBRE SINGLE MODE CABLE OR 2 X 12 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING. 24 X SCA SIMPLEX THROUGH ADATPER S 24 X SCA PIGTAILS 24 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-48SS/SCA-UOM-1	2RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 1 X 48 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMB ERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 48 X SCA SIMPLEX THROUGH ADATPERS 48 X SCA PIGTAILS 48 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-48SS/SCA-UOM-2	2RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 2 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 48 X SCA SIMPLEX THROUGH ADATPERS 48 X SCA PIGTAILS 48 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-72SS/SCA-UOM-1	3RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 1 X 72 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 72 X SCA SIMPLEX THROUGH ADATPERS 72 X SCA PIGTAILS 72 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-72SS/SCA-UOM-3	3RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 3 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 72 X SCA SIMPLEX THROUGH ADATPERS 72 X SCA PIGTAILS 72 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-96SS/SCA-UOM-1	3RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 1 X 96 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 96 X SCA SIMPLEX THROUGH ADATPERS 96 X SCA PIGTAILS 96 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES

FRE-96SS/SCA-UOM-2	3RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 2 X 48 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 96 X SCA SIMPLEX THROUGH ADATPERS 96 X SCA PIGTAILS 96 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-96SS/SCA-UOM-4	3RU SLIDING STATIC ENCLOSURE FOR LOOSE TUBE OUTDOOR CABLE ONLY. TO SUIT 4 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 96 X SCA SIMPLEX THROUGH ADATPERS 96 X SCA PIGTAILS 96 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES

Single Mode (OS1) Pre-terminated Indoor

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12WB/SCA-UOM-1	1RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 1 X 12 FIBRE SINGLE MODE CABLE VERTICAL NUMBERING (A) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING 12 X SCA SIMPLEX THROUGH ADAPTERS CABLE MANAGEMENT TRAY & COVER
FRE-24WB/SCA-UOM-1	1RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 2 X 12 FIBRE SINGLE MODE CABLE OR 1 X 24 FIBRE SINGLE MODE CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 24 X SCA SIMPLEX THROUGH ADAPTERS CABLE MANAGEMENT TRAY & COVER
FRE-48WB/SCA-UOM	2RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 2 X 24 FIBRE SINGLE MODE CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 48 X SCA SIMPLEX THROUGH ADAPTERS CABLE MANAGEMENT TRAY PERSPEX COVER
FRE-72WB/SCA-UOM	3RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 3 X 24 FIBRE SINGLE MODE CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 72 X SCA SIMPLEX THROUGH ADAPTERS CABLE MANAGEMENT TRAY PERSPEX COVER
FRE-96WB/SCA-UOM	3RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 4 X 24 FIBRE SINGLE MODE CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 96 X SCA SIMPLEX THROUGH ADAPTERS CABLE MANAGEMENT TRAY PERSPEX COVER

Multimode (OM3) – Pre-terminated Indoor

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12WB/SC-UOM	1RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 1 X 12 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING 12 X SC OM3 AQUA SIMPLEX THROUGH ADAPTERS 2 X VELCRO CABLE TIES
FRE-24WB/SC-UOM	1RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 2 X 12 FIBRE OM3 CABLE OR 1 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 24 X SC OM3 AQUA SIMPLEX THROUGH ADAPTERS 2 X VELCRO CABLE TIES
FRE-48WB/SC-UOM	2RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 4 X 12 FIBRE OM3 CABLE OR 2 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 48 X SC OM3 AQUA SIMPLEX THROUGH ADAPTERS 2 X VELCRO CABLE TIES
FRE-72WB/SC-UOM	3RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 6 X 12 FIBRE OM3 CABLE OR 3 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 72 X SC OM3 AQUA SIMPLEX THROUGH ADAPTERS 2 X VELCRO CABLE TIES
FRE-96WB/SC-UOM	3RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 8 X 12 FIBRE OM3 CABLE OR 4 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 96 X SC OM3 AQUA SIMPLEX THROUGH ADAPTERS 2 X VELCRO CABLE TIES

Single Mode (OS1) – Spliced Indoor

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12S/SCA-UOM	1RU SLIDING ENCLOSURE FOR INDOOR/OUTDOOR CABLE ONLY. TO SUIT 1 X 12 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING. 12 X SCA SIMPLEX THROUGH ADATPERS 12 X SCA PIGTAILS 12 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-24S/SCA-UOM	1RU SLIDING ENCLOSURE FOR INDOOR/OUTDOOR CABLE ONLY. TO SUIT 2 X 12 FIBRE SINGLE MODE CABLE OR 1 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 24 X SCA SIMPLEX THROUGH ADATPERS 24 X SCA PIGTAILS 24 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND 2 X VELCRO CABLE TIES
FRE-48S/SCA-UOM	2RU SLIDING ENCLOSURE FOR INDOOR/OUTDOOR CABLE ONLY. TO SUIT 2 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 48 X SCA SIMPLEX THROUGH ADATPERS 48 X SCA PIGTAILS 48 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 2 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-72S/SCA-UOM-3	3RU SLIDING ENCLOSURE FOR INDOOR/OUTDOOR CABLE ONLY. TO SUIT 3 X 24 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 72 X SCA SIMPLEX THROUGH ADATPERS 72 X SCA PIGTAILS 72 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X SHARED CABLE GLAND CONDUIT 2 X VELCRO CABLE TIES
FRE-96S/SCA-UOM	3RU SLIDING ENCLOSURE FOR INDOOR/OUTDOOR CABLE ONLY. TO SUIT 4 X 24 FIBRE SINGLE MODE CABLE OR 2 X 48 FIBRE SINGLE MODE CABLE OR 1 X 72 FIBRE SINGLE MODE CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 96 X SCA SIMPLEX THROUGH ADATPERS 96 X SCA PIGTAILS 96 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 4 X CABLE GLANDS 2 X VELCRO CABLE TIES

Singlemode (OS1) – Pre-terminated Indoor

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12WB/SCA-UOM	1RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 1 X 12 FIBRE OS1 CABLE. VERTICAL NUMBERING (A) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING. 12 X SCA OS1 GREEN SIMPLEX THROUGH ADATPERS 2 X VELCRO CABLE TIES
FRE-24WB/SCA-UOM	1RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 2 X 12 BUNDLED FIBRE OS1 CABLE OR 1 X 24 FIBRE OS1 CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 24 X SCA OS1 GREEN SIMPLEX THROUGH ADATPERS 2 X VELCRO CABLE TIES
FRE-48WB/SCA-UOM	2RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 4 X 12 BUNDLED FIBRE OS1 CABLE OR 2 X 24 BUNDLED FIBRE OS1 CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 48 X SCA OS1 GREEN SIMPLEX THROUGH ADATPERS 2 X VELCRO CABLE TIES
FRE-72WB/SCA-UOM	3RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 6 X 12 BUNDLED FIBRE OS1 CABLE OR 3 X 24 BUNDLED FIBRE OS1 CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 72 X SCA OS1 GREEN SIMPLEX THROUGH ADATPERS 2 X VELCRO CABLE TIES
FRE-96WB/SCA-UOM	3RU WINGBACK ENCLOSURE FOR PRETERMINATED INDOOR CABLE ONLY. TO SUIT 8 X 12 BUNDLED FIBRE OS1 CABLE OR 4 X 24 BUNDLED FIBRE OS1 CABLE. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING. 96 X SCA OS1 GREEN SIMPLEX THROUGH ADATPERS 2 X VELCRO CABLE TIES

Multimode (OM3) – Indoor / Outdoor Cable

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12S/SC-UOM	1RU SLIDING ENCLOSURE FOR INDOOR OUTDOOR CABLE ONLY. TO SUIT 1 X 12 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING 12 X SC AQUA SIMPLEX THROUGH ADAPTERS 12 SC OM3 PIGTAILS 12 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 1 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-24S/SC-UOM-1	1RU SLIDING ENCLOSURE FOR INDOOR OUTDOOR CABLE ONLY. TO SUIT 1 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 24 X SC AQUA SIMPLEX THROUGH ADAPTERS 24 SC OM3 PIGTAILS 24 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 2 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-24S/SC-UOM-2	1RU SLIDING ENCLOSURE FOR INDOOR OUTDOOR CABLE ONLY. TO SUIT 2 X 12 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 1 TO 12	COUPLER PANELS - VERTICAL NUMBERING 24 X SC AQUA SIMPLEX THROUGH ADAPTERS 24 SC OM3 PIGTAILS 24 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 2 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-48S/SC-UOM	2RU SLIDING ENCLOSURE FOR INDOOR OUTDOOR CABLE ONLY. TO SUIT 2 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 48 X SC AQUA SIMPLEX THROUGH ADAPTERS 48 X SC OM3 PIGTAILS 48 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 2 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-72S/SC-UOM	3RU SLIDING ENCLOSURE FOR INDOOR OUTDOOR CABLE ONLY. TO SUIT 3 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 72 X SC AQUA SIMPLEX THROUGH ADAPTERS 72 X SC OM3 PIGTAILS 72 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 3 X CABLE GLAND 2 X VELCRO CABLE TIES
FRE-96S/SC-UOM	3RU SLIDING ENCLOSURE FOR INDOOR OUTDOOR CABLE ONLY. TO SUIT 3 X 24 FIBRE OM3 CABLE VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO 24 VERTICAL NUMBERING (C) 1 TO 12 VERTICAL NUMBERING (D) 13 TO 24 VERTICAL NUMBERING (E) 1 TO 12 VERTICAL NUMBERING (F) 13 TO 24 VERTICAL NUMBERING (G) 1 TO 12 VERTICAL NUMBERING (H) 13 TO 24	COUPLER PANELS - VERTICAL NUMBERING 96 X SC AQUA SIMPLEX THROUGH ADAPTERS 96 X SC OM3 PIGTAILS 96 X SPLICE PROTECTORS 1 X SPLICE CASSETTE STACK 4 X CABLE GLAND 2 X VELCRO CABLE TIES

Single-Mode OS1 – MTP

AFL PART NUMBER	DESCRIPTION	CONTENTS
FRE-12WB-MTP/SCA-UOM	1RU WINGBACK ENCLOSURE FOR RUGGEDISED MTP ROUND MINI CABLE YELLOW SHEATH TO SUIT 1 X 12C MTP OS1 FIBRE CABLE. VERTICAL NUMBERING (A) 1 TO 12	1 X SD MTP OS1 SCA SX ANGLED CASSETTE 12 X SCA OS1 GREEN SIMPLEX THROUGH ADAPTORS 1 X BLANK ADAPTOR PLATE 2 X VELCRO CABLE TIES
FRE-24WB-MTP/SCA-UOM	1RU WINGBACK ENCLOSURE FOR RUGGEDISED MTP ROUND MINI CABLE YELLOW SHEATH. TO SUIT 2 X 12C MTP OS1 FIBRE CABLES. VERTICAL NUMBERING (A) 1 TO 12 VERTICAL NUMBERING (B) 13 TO24	2 X SD MTP OS1 SCA SX ANGLED CASSETTE 24 X SCA OS1 GREEN SIMPLEX THROUGH ADAPTORS 2 X VELCRO CABLE TIES

Outdoor Cable

AFL PART NUMBER	DESCRIPTION	CONTENTS
LMD61DPA012BE	AFL 12 FIBRE OS1/2 LOOSE TUBE NYLON CABLE	AFL BRANDED
LMD61DPA024BE	AFL 24 FIBRE OS1/2 LOOSE TUBE NYLON CABLE	AFL BRANDED
LMD61DPA048BE	AFL 48 FIBRE OS1/2 LOOSE TUBE NYLON CABLE	AFL BRANDED
LMD61DPA172BE	AFL 172 FIBRE OS1/2 LOOSE TUBE NYLON CABLE	AFL BRANDED
LMD61DPA1144BE	AFL 1144 FIBRE OS1/2 LOOSE TUBE NYLON CABLE	AFL BRANDED

Indoor Cable

AFL PART NUMBER	DESCRIPTION	CONTENTS
TWBP1FAA012YW	AFL 12 FIBRE OS1/2 SINGLE MODE TIGHT BUFFERED CABLE	AFL BRANDED
TWBP1FAA024YW	AFL 24 FIBRE OS1/2 SINGLE MODE TIGHT BUFFERED CABLE	AFL BRANDED
TWBP1FAA048YW	AFL 48 FIBRE OS1/2 SINGLE MODE TIGHT BUFFERED CABLE	AFL BRANDED

Single Mode Pre-terminated

AFL PART NUMBER	DESCRIPTION	CONTENTS
R1SCASCA*XX*M-12-5911	PRETERMINATED SINGLE MODE 12 FIBRE RISER CABLE	INDOOR RISER CABLE LSZH SHEATH
	XX DENOTES LENGTH	
	SCA TO SCA WITH BOTH ENDS OVERSLEEVED	
R1SCASCA*XXM*-24-5911	PRETERMINATED SINGLE MODE 24 FIBRE RISER CABLE	INDOOR RISER CABLE LSZH SHEATH
	XX DENOTES LENGTH	
	SCA TO SCA WITH BOTH ENDS OVERSLEEVED	

Single Mode MTP

AFL PART NUMBER	DESCRIPTION	CONTENTS
RRM 1 MTPFA *XX*M-12-A	AFL 12 FIBRE OS2 MTP RUGGERDIZED ROUND MINI CABLE	INDOOR RISER CABLE LSZH SHEATH
	XX DENOTES LENGTH	
	CABLE TO BE USED FOR INDOOR APPLICATION ONLY	

Multimode Pre-terminated

AFL PART NUMBER	DESCRIPTION	CONTENTS
R3SCSC*XX*M-12-5D11	PRETERMINATED MULTIMODE OM3 12 FIBRE RISER CABLE	INDOOR RISER CABLE LSZH SHEATH
	XX DENOTES LENGTH	
	SC TO SC WITH BOTH ENDS OVERSLEEVED	
R3SCSC*XX*M-24-5D11	PRETERMINATED MULTIMODE OM3 24 FIBRE RISER CABLE	INDOOR RISER CABLE LSZH SHEATH
	XX DENOTES LENGTH	
	SC TO SC WITH BOTH ENDS OVERSLEEVED	

Copper Structured Cable

PANDUIT PART NUMBER	DESCRIPTION
PUL6AV04WH-EG	PANDUIT Cat6A U/UTP VARI MATRIX 23 AWG, LSZH CABLE, WHITE, 305m
PUL6AV04BU-EG	PANDUIT Cat6A U/UTP VARI MATRIX 23 AWG, LSZH CABLE, BLUE, 305m
PUL6AV04WH-ED	PANDUIT Cat6A U/UTP VARI MATRIX 23 AWG, LSZH CABLE, WHITE, 500m
PUL6AV04BU-ED	PANDUIT Cat6A U/UTP VARI MATRIX 23 AWG, LSZH CABLE, BLUE, 500m
PFL6X04WH-CEG	PANDUIT Cat6A F/UTP 23 AWG, LSZH CABLE, WHITE, 305m
PFL6X04BU-CEG	PANDUIT Cat6A F/UTP 23 AWG, LSZH CABLE, BLUE, 305m

Copper Patch Cable

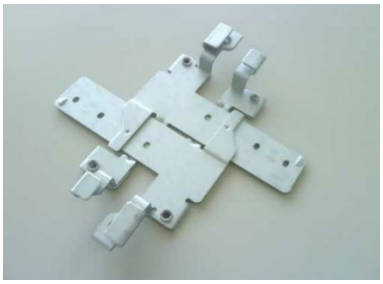
PANDUIT PART NUMBER	DESCRIPTION
UTP28X*YY*M*ZZ*	PANDUIT Cat6A 28 AWG PERFORMANCE PATCH LEAD
	YY DENOTES LENGTH
	ZZ DENOTED COLOUR *BU – Blue* *OR – Orange* *VL – Violet*
UTP28X0.5M	PANDUIT Cat6A 28 AWG PERFORMANCE PATCH LEAD, WHITE *FOR USE ON CONNECTING WIRELESS AP's TO OUTLET ONLY*

12.4 Appendix D –Wireless Access Point Mounting – Supplementary Information

Indoor Mounting Plaster / Exposed Concrete Slab / Timber or Steel Exposed Beam

AIR-AP-BRACKET-1

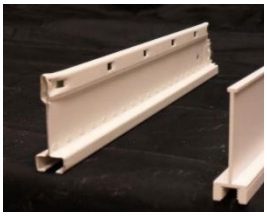
Suspended / False Ceiling



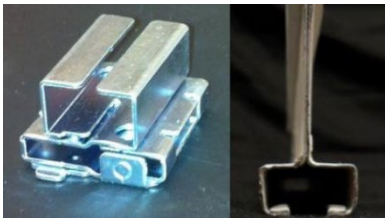
AIR-AP-T-RAIL-R

AIR-AP-T-RAIL-F

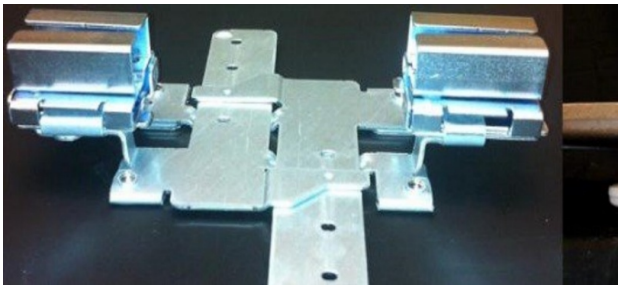
The following images show mounting components for false ceiling channel mounting methods



Channel rails (false ceiling)



AIR-CHNL-ADAPTER



Final installation

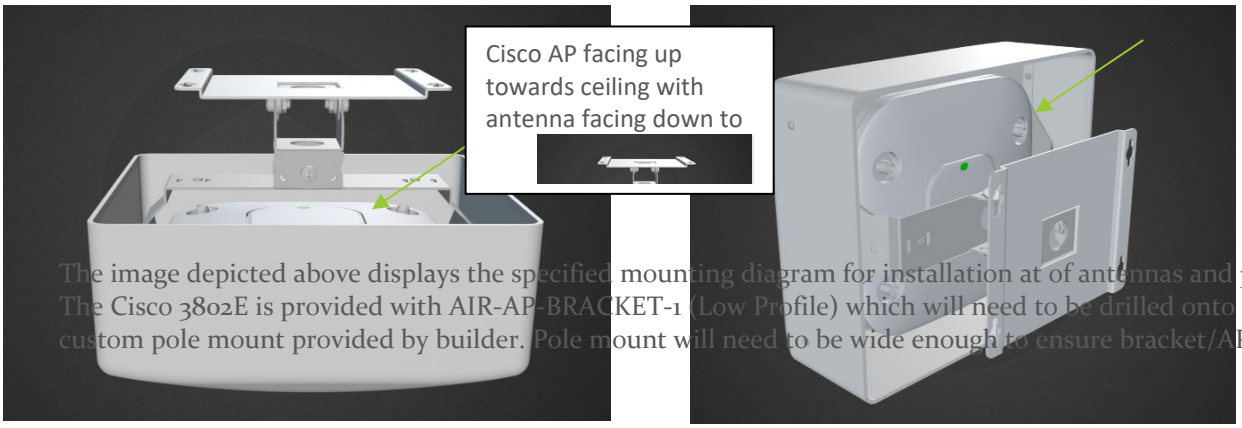
Wall Mounting

Threaded Rods and Pole mounts

Using threaded rod and Conduit to hide cables

Where threaded rod can not be used due to length

Mouting Antennas and Aps from threaded rods and pole mounts:

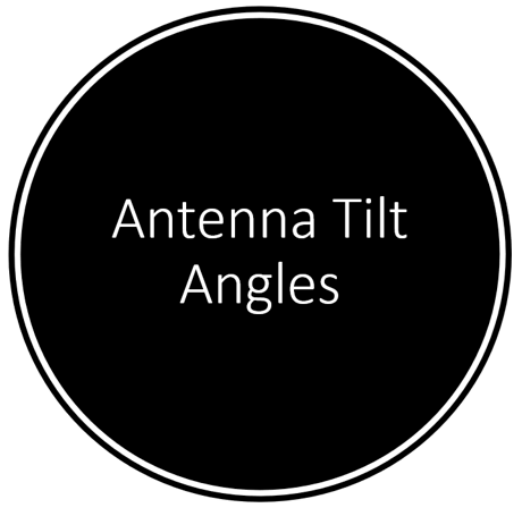


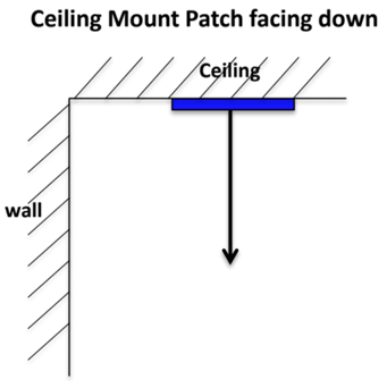
The image depicted above displays the specified mounting diagram for installation at of antennas and 3802E AP. The Cisco 3802E is provided with AIR-AP-BRACKET-1 (Low Profile) which will need to be drilled onto the custom pole mount provided by builder. Pole mount will need to be wide enough to ensure bracket/AP can fit.

Specifications for Cover + Bracket can be found at:

https://oberoninc.com/products/1013-cover/

All antennas will be using “Ceiling Mount Patch facing down” as seen in diagram below. This ensure the signal is directly provided to the client free from obstruction.





Mounting of Access points and Antennas at Lecture theatres:

UDITORIUM

12.5 Appendix E - Wireless Service – Minimal Service Criteria

Wireless Space Definitions

- Low Client density areas: These areas will have lower AP count and lower client density and may include outdoor areas, walkways, corridors, administrative blocks and office areas. AP placement is based on coverage area not ratio of users.

- Average Client density areas: General areas in the campus like classrooms, walkways, corridors, administrative blocks and office areas. An AP to client ratio of 1:40-50 maximum should be maintained in these areas.

- High Client density area: These areas are typically lecture theatres and teaching spaces that cater for a high concentration of wireless users. An AP to client ratio of 1:30 maximum should be maintained in these areas.

- Outdoor Areas: These areas will be covered by external access points and AP placement is based on coverage area not ratio of users.

Minimal Service Criteria

- For space classifications of low density with a base data user requirements; predictive surveys shall have a minimum signal level of -67dBm on the 5GHz radio and -70dBm on the 2.4GHz radio across the coverage area at 25mW. Cells shall have a 15-20% overlap.

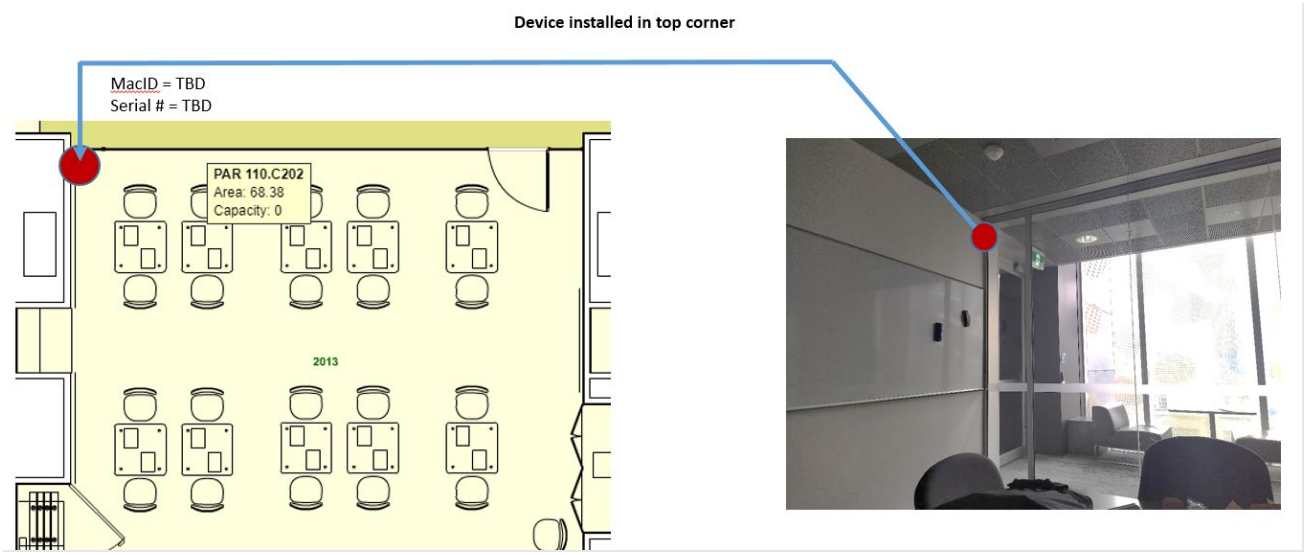
- For space classifications of high density or requiring high throughput data applications locations, predictive surveys shall have a minimum signal level of -67dBm or better at 13mW (11 dBm)/25 mW (14 dBm) . Cells shall have a 10-15% overlap.

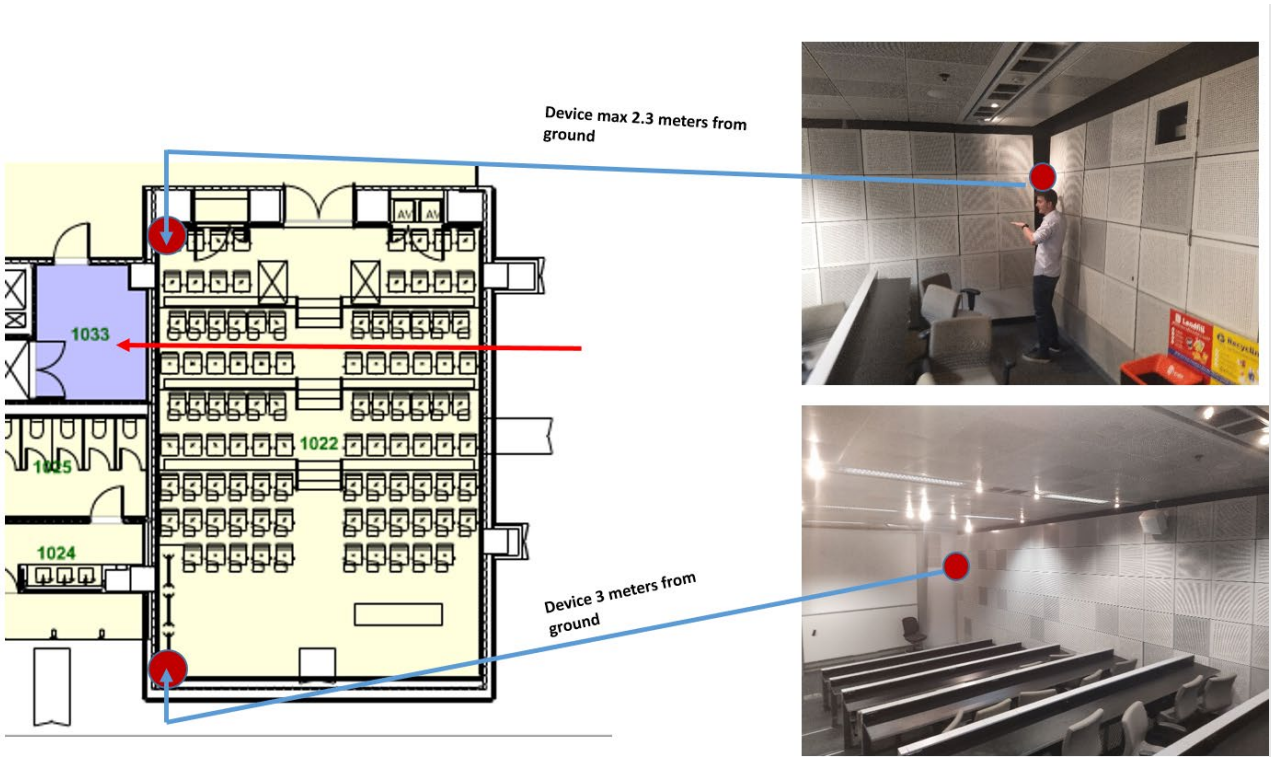
- For space classifications of average density with voice user requirements; an Active/passive (AP on a stick) surveys will be conducted and shall have a minimum signal level of -65dBm on the 5GHz radio and -65dBm on the 2.4GHz radio across the coverage area with transmit power nor exceeding 25mW. Coverage cells should have a 20% overlap

12.6 Appendix F – Mouting Examples; Steintel People Counters

The following figures provide example guidance on the placement of cameras supporting the Steintel people counters.

The following figure shows the standard deployment using a single camera:



Note: Each Steintel camera has an effective field of view within a 10 metre radius of the camera mounting position.

The below figure shows a deployment where two Steintel cameras have been combined to provide coverage of the areas in question: