



UNSW Communications Design and Installations Standards

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Version	Document Status	Date	Author
4.18	Consolidation of Communications Specification for the UNSW - UTP V2.11, Backbone V2.7, Contractors V1.5.	15 th May 2015	ITCS
4.19	Various materials updated/changed.	14 th July 2015	ITCS
4.20a	Summary of key changes: • Wireless density increases to 1 base station per 15 devices for student teaching and associated areas. 1:20 remains for other areas. • Mention of different wireless requirements for student accommodation. • Extended review period required for wireless layout designs. • Materials – manufacturer's part numbers updated. • 2 x 20amp power required for Building Distributor (BD) cabinet. • Rear cable rails required in BD cabinet. • Fibre installation overview for High Bandwidth installations. • Optical Isolator - increase outlet numbers, increase power outlets, new example methods & drawings. Confirmation of requirements by EM for each installation. • Confirmation by building service providers/owners of network operation requirements during power outages. • Fire Panel – new requirement, UTP outlet for data network connection.	3 rd June 2016	ITCS

4.20.1	Updated part numbers, Standards of Compliance & Wireless design.	29 th July 2020	ITCS
5.0	Complete review of the existing standards	30 th October 2025	ITCS

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1. Overview

1.1. Introduction

This document defines the mandatory standards for the design and installation of the UNSW Network. All network cabling and associated works across UNSW campuses, including within retail tenancies - must comply with the requirements outlined herein, in addition to current industry and vendor specifications.

Inclusion of this document in all Major Works project documentation is compulsory to ensure final deliverables meet the operational and technical requirements of the University of New South Wales. It must accompany the detailed design specification for each project, with the applicable version number clearly referenced.

All stakeholders, including UNSW Estate Management (EM), architects, builders, services consultants, and installation contractors - are required to be familiar with the contents of this document and adhere to its provisions.

No deviations from the UNSW ITCS Design and Installation Standards are permitted without prior written approval from UNSW IT Customer Service Delivery (ITCS). Such approval must be obtained before the procurement of materials or commencement of any related works.

UNSW adopts a wireless-first approach to network design. All new buildings, refurbishments, and workspace designs must prioritise wireless connectivity as the primary method of access for staff, students, laboratories, offices, and teaching spaces. Wired Ethernet cabling will continue to be provided where required for high-bandwidth, fixed, or specialised devices, but the default planning and design is to deliver services primarily over the wireless network.

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1.2. Ownership

The UNSW IT Customer Service Delivery (ITCS) department is responsible for approving the design and installation of all new projects, including remediation works and infrastructure modifications. ITCS also oversees the ongoing operation of all voice and data networks and associated infrastructure across UNSW campuses, acting on behalf of the University and its members.

With this responsibility comes the authority to take necessary actions to safeguard the integrity of the network and mitigate potential risks to the University community. To ensure consistency and compliance with established standards, ITCS is the sole authority permitted to approve the installation, relocation, or decommissioning of communications passive infrastructure and network equipment connections. For further information, please refer to the UNSW Acceptable Use of ICT Resources Policy.

UNSW Estate Management (EM) must formally notify and engage ITCS at the outset of any project discussions or decisions that may impact ITCS communications services or infrastructure. ITCS must be invited to participate in all relevant meetings and decision-making processes to ensure alignment with network standards and operational requirements.

1.3. Terms, Abbreviations and Definitions

Term	Description
ACMA	Australian Communications & Media Authority
<i>Active Network Equipment</i>	The active equipment required to operate the University's data network. These devices provide transient services and include switches, routers, and wireless access points. All such equipment to be connected to the UNSW data network is supplied by ITCS.
<i>Approved/authorised in writing</i>	Paper or email authorisation/approval has been issued by ITCS.
AS/NZS	Australian Standards/ New Zealand Standards
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AV	Audio Visual
<i>Backbone Cabling</i>	Provides interconnection between the Building Distributor and Floor Distributor.
BDR	Building Distribution Room (formerly "main comms room", "MDF").
BMS	Building Management System
<i>Builder</i>	The builder or Head/Managing Contractor for the project.
<i>Building Distributor</i>	The distributor between the Campus Backbone Cabling and the Building Backbone Cabling.
<i>Campus Backbone Cabling</i>	Provides interconnections between the Campus Distributor and the Building Distributor.
<i>Campus Distributor</i>	The head end/s of the Campus backbone cabling system.
CDR	Campus Distribution Room (formerly "core")
CET	Communications Earthing Terminal
CES	Communications Earthing System

<i>Communications Infrastructure</i>	All passive and active components of the UNSW communications plant.
<i>Communications Room</i>	Equipment rooms reserved to house communications cabinets, cabling and active equipment. The Campus Distributor, Building Distributor and Floor Distributors are housed in Communications Rooms.
<i>CRS</i>	Computer Room Solutions
<i>DAS</i>	Distributed Antenna System
<i>Db</i>	Decibels
<i>Contractor</i>	The contractor or subcontractor company awarded the contract for supply, installation & certification for UNSW communications systems requested in the Overall Project.
<i>Emacs</i>	Energy Management and Control Systems
<i>External Telecommunications Providers</i>	Public telecommunications organisations providing services to UNSW.
<i>EM</i>	UNSW Estate Management Department
<i>FDR</i>	Floor Distribution Room (formerly “edge comms room”).
<i>FIP</i>	Fire Indicator Panel
<i>FFL</i>	Finished Floor Level
<i>Floor Distributor</i>	The distributor between building backbone cabling and horizontal cabling.
<i>GPO</i>	General Purpose Outlet
<i>Horizontal Cabling</i>	Connects the Floor Distributor to telecommunications outlet in work areas.
<i>HSRN</i>	High Speed Research Network
<i>IBC</i>	In Building Coverage
<i>ICT</i>	Information and Communications Technology
<i>IDF</i>	Intermediate Distribution Frame
<i>IEC</i>	International Electro Technical Commission
<i>Industry and vendor’s standards.</i>	The standards listed in Section 4. The cable vendor installation standards.
<i>ISO</i>	International Organization for Standards
<i>ITCS</i>	UNSW IT Customer Service

<i>ITCS Engaged</i>	Formal engagement of ITCS has been secured via a Service Desk Request.
<i>Major Works</i>	Construction works classified by UNSW EM as Major Works.
<i>MATV</i>	Master Antenna Television
<i>Other Services</i>	All building services/trades that are not UNSW voice or data network services. For example, other services include but are not limited to Security, BMS, MATV, DAS electrical & mechanical services.
<i>MDF</i>	Main Distribution Frame
<i>MMF</i>	Multimode Fibre
<i>PN</i>	Part Number
<i>POE</i>	Power Over Ethernet
<i>Principal</i>	UNSW EM Planning or the Principal's authorised agent.
<i>Project/Overall Project</i>	The entire project from initial planning through to occupation, including all works to complete the project.
<i>Project Specification</i>	The Specification that describes the particular design and installation requirements for each project.
<i>Project Team</i>	Generally, this means the team responsible for the day-to-day management of the project. The team may include the Principal and the Principal's authorised agents, the Architect, the Builder/main contractor and others authorised to make decisions or responsible for communications between various project participants. For example, <i>submit to the project or project team</i> means submit via the approved communications channels to the most appropriate recipient.
<i>RP3</i>	<i>Remote Powering Class 3</i>
<i>RU</i>	Rack Unit
<i>SCS</i>	Structured Cabling System
<i>SmartPDU</i>	Smart Power Distribution Unit
<i>SMF</i>	Single Mode Fibre
<i>STP</i>	Shielded Twisted Pair
<i>TBB</i>	Telecommunications Bonding Backbone
<i>TGB</i>	Telecommunications Grounding Busbar

<i>The Works</i>	The services and goods to be delivered by the Contractor.
<i>The network</i>	UNSW IT Customer Service Delivery voice & data network.
<i>TMGB</i>	Telecommunications Main Grounding Busbar
<i>TO</i>	Telecommunication Outlet
<i>To be submitted</i>	Information to be submitted to ITCS via the agreed communication channel for the specific project, unless otherwise advised in this document.
<i>TR</i>	Telecommunications Room
<i>UNSW</i>	The University of New South Wales.
<i>UNSW EM</i>	UNSW Estate Management
<i>UNSW IT</i>	The UNSW IT Department
<i>UNSW Network</i>	UNSW IT Customer Service Delivery voice & data network.
<i>UPS</i>	Uninterruptable Power Supply
<i>“Vendors” certification program</i>	Certification programs offered by Cabling System vendors that installers (the contractor) must hold. The Certification is only applicable under the vendors program to certified installers.
<i>VLAN</i>	Virtual Local Area Network
<i>WAP</i>	Wireless Access Point

2. General Design Standards

2.1. Enabling Works Design

Due to the potential complexity and long lead times associated with Enabling Works, it is mandatory that ITCS is invited to participate in the initial planning for all projects that may involve internal or external Enabling Works.

Widespread network disruptions can result from the failure to consider the wider implications of the proposed works. Activities such as detailed planning of outages, approval by the IT Change Advisory Board, stakeholder notification, coordination and network changes as and when required, agreement on hold points as well as sufficient time for planning and implementation of each stage are critical. As such, the early engagement of ITCS and ongoing provision of detailed information as well as scheduling and coordination between all parties is critical.

UNSW EM, builders and contractors do not have the authority to access communications rooms, risers, or pits without the specific knowledge and approval by ITCS on each occasion. Communications outlets and/or cables are not to be decommissioned or moved or new outlets installed without ITCS written approval of the detailed specification for each piece of work. Once the specified work is approved by ITCS it must be carried out by suitably certified contractors. As-builts and associated documentation is to be provided on completion.

It is the responsibility of the project to fully document existing external services layout drawings, complete with dimensions to locate each service and service type, the depth of service cabling as well as the source and destination of each cable and forward these drawings together with shop drawings for review & written approval by ITCS prior to any excavation work being undertaken.

For all works affecting communications services, it is a mandatory condition that the leading hand of the communications contractor engaged by any party to work on any UNSW sites meets with ITCS to review the final specification or design documents to clarify any uncertainties by either party prior to commencement of work on site.

All IT infrastructure (both active and passive) within communications cabinets can only be installed or removed by ITCS personnel or ITCS approved third party personnel. Wireless Access Points (WAPs), telephony endpoints, and other endpoints may be removed by contractors when specifically instructed to do so by ITCS. All equipment removed by contractors is to be returned to ITCS.

If authorised by ITCS, assistance can be provided by ITCS to arrange passive cabling to builder's temporary site sheds. Builders are not authorised to install cables in communications rooms, communications risers or internal or external cable routes without written authorisation by ITCS.

2.2. Communications Rooms Design

The communications room locations, sizes and layout will vary for each building to provide the most appropriate passive and active design within the context of the overall UNSW network design. The following standards are to be followed by architects or other designers during the design of communications rooms within new or refurbished UNSW buildings. ITCS must directly participate in the design process from the first stages of concept design and will provide the standards and written approval of designs at scheduled milestones from the preliminary through to final designs. This section is to be read in conjunction with Section 2.4 below.

- ITCS is to participate directly in discussions with the planner, architect, or designer at the commencement of the initial planning/design stage to ensure the requirements are understood and options can be discussed. The final communications room and riser design, as well as the proposed layout, will be provided by or approved in writing by ITCS prior to finalisation of the structural or other designs that may inhibit changes to room sizes and shape and/or riser locations and sizes. If any component of the communications room design changes after the initial approval, ITCS is to be advised of the details of the changes, the reasons for the change and written approval sought by the project. For example, changes to communications room size; dimensions (width, length and height); the size or location of the door; overall layout or changes to other services' space requirements; the riser size or location; the location or additional requirements for other services to be accommodated within the riser. ITCS reserves the right to reject any changes deemed detrimental to the communications services design.
- All communications rooms are to be vertically stacked above each other. If a second stack is required due to the size of the floor plate they should also be vertically stacked.

- Locating communications rooms directly above, below, or beside wet areas is not acceptable.
- The measured cable length from the patch panel in the communications cabinet to the farthest possible terminated field outlet at the edge of the building is not to exceed 90m. As a rule of thumb, the measured length along the entire cable route on the plan, including the route within the communications room, vertical routes, routes via skirting duct around walls, through joinery and workstations should not be greater than 65m. This allows for the inevitable route variations that occur during construction.
- It is recommended that communications rooms and risers are positioned centrally within the building to limit the need for a second stack of rooms and risers. They should be positioned away from electrical substations, switch rooms, electrical risers, major mechanical plant or ducts, hydraulic, other services ducts, or risers. Communications Services infrastructure has no reliance on proximity to any other services, and separation reduces the risk of services reticulation congestion and pinch points in corridors.
- Communications rooms are to be a minimum of 3.5 metres deep and as long as required to fit the number of communications cabinets to be installed and any other wall mounted communications infrastructure or equipment, plus space for extra cabinet/s to be installed in the future. At least 1 metre clear walk around space at the end of the ganged cabinets (over and above the space reserved for future cabinets), is to be provided to enable access from the front to the back of the cabinets.
- A minimum of 45% spare cabinet capacity is to be provided in every communications room based on the maximum cabinet fill as specified within the current ITCS cabinet layout standards. For example in a cabinet designed for a maximum of 10 patch panels, if there is one cabinet with 7 patch panels installed, a second cabinet is to be installed with appropriate ties; if there are two cabinets with one at 100% capacity (10 patch panels) and the second at 50% capacity (5 patch panels) a third cabinet is to be installed. In some instances, extra space for additional cabinet/s or spare capacity within the installed cabinets may be required. This will be especially relevant where the current user requirements for communications outlets are very sparse, there are cold shell spaces to be fitted out in the future or known requirements for a reasonable quantity of additional cabling to some areas in the future.
- The entrance door to the communications room is to be wide enough to allow 800mm x 760mm cabinets to pass through the opening, but not so large that the full door opening obstructs the 1 metre reserved space in front of cabinets.
- Room entrance is required to have swipe-based access control.
- Additional space within the room will be required for approved other services equipment, for example an electrical distribution board or security equipment.
- The minimum dimensions of rooms and risers must be internal and free of columns, ducts or other intrusions into the space. The communications riser, wall mounted equipment (or other services risers or equipment) must be outside the required minimum cabinet clearances.
- The rectangular shape of 3.5m (minimum width) x 4.2m or 5m or 6m (as required) is preferred to square or irregular shapes. This allows cabinets to be ganged side by side which is the preferred layout and maximises space utilisation. The size of rooms will vary in response to the specific requirements for that location.
- The size of each room is directly related to the number of communications outlets to be installed to that room during construction and the required spare capacity for the future.

Therefore, room and riser dimensions cannot be finally approved until there is a reasonable quantitative understanding of the occupant requirements.

- ITCS recommends that communications rooms are designed to minimize their overall footprint within the building while maintaining compliance with cabling topology requirements. Communications rooms shall be vertically stacked and aligned to support efficient riser distribution. Horizontal (structured) cabling shall terminate only within the communications room serving the same floor, and no horizontal or structured cabling is permitted to run between floors.

This approach is best achieved by providing appropriately sized, centrally located communications rooms on each floor, aligned vertically, rather than multiple smaller rooms distributed at the perimeter of the building. For example, a communications room housing one cabinet requires a minimum area of 6.3 m²; two cabinets require 9.1 m²; and three cabinets require 12 m². Providing one cabinet in each of three separate communications rooms would consume 18.9 m² and require duplication of mechanical and associated services. The final number and location of communications rooms shall be determined by the total floor plate size, the location of communications rooms and risers, and compliance with maximum horizontal cable length requirements. The exact layout and orientation of the cabinets and other equipment will vary according to the location and dimensions of the room, the proposed location of the riser and the location of the door.

- Power Continuity Considerations for Network-Dependent Building Services and end points. The Project team should engage with all relevant building services stakeholders (e.g. Security, BMS, Energy Monitoring, CCTV) to confirm their expectations regarding network service continuity during power outages. The design must account for the operational requirements of end devices that rely on Power over Ethernet (PoE) from network switches. This includes assessing the impact of power loss on these devices and ensuring appropriate measures are in place to maintain their functionality during outages or maintenance events. These considerations will directly inform decisions regarding the specification of electrical design, deployment of UPS and/or generator backup systems for communications infrastructure. A UPS is required to support the uninterrupted operations of communications equipment; It is preferred that a separate building wide UPS system is provided to service all communication locations. If a UPS must be installed within the communications room, additional space that does not impinge on specified access requirements for communications cabinets or spare capacity is to be allowed. UPSs are not to be installed in communications cabinets.
- All communications rack circuits must be supplied by a central building UPS. The UPS shall be sized for 130% of day-1 capacity, with 20 minutes of autonomy at end of life. A modular-style centralised UPS may be used where capacity is expected to increase over time. The preferred location for the UPS is at the basement of the building in a cooled, access-controlled space, with an independent distribution board feeding localised load centres in each communications room. Regardless of location, UNSW EM is responsible for ongoing UPS maintenance and lifecycle management.
- Services other than UNSW voice and data network cabling and cabinets are not to be installed in communications rooms or communications risers without the written authority of ITCS. Other services include Security, MATV, IBC/DAS, BMS, metering, or any other building service.

- Prior to ITCS considering an installation request to share communications room space, the exact space requirements for other services cabling, trays, equipment and risers must be incorporated into the overall communications room size and general design. Separate cabinets, wall space, baskets, trays, power and riser space as specified in the approval are to be provided for those services. If the space or location requirements change for any reason, the revised requirements are to be resubmitted for written approval prior to installation. ITCS reserves the right to reject initial requests or subsequent changes.
- Non-ITCS approved infrastructure and services installed without written authorisation will be removed at the project's expense.
- Communications cabinets are not to be used to house Security equipment, UPS or any equipment not installed and managed by ITCS without written approval by ITCS.
- The minimum slab to soffit room height is 3 metres to ensure adequate vertical clearance.
- Ceiling tiles are not permitted in communications rooms as per AS/NZ3084:2017 standard.
- Internal plasterboard walls or similar used as a lining for concrete walls are not to be installed in communications rooms.
- Thermal Load Assessment must be considered in the design.
- All concrete surfaces within the communications room are to be sealed (via a durable clear sealant, paint or other approved method) prior to the installation of communications cabinets and cabling.
- Mechanical requirements are to be considered during the design process to ensure that mechanical duct or equipment installation does not affect the communications room cabinets or overhead or wall cable reticulation. Ducts or equipment providing services to the room are not to be positioned above communications cabinets or anywhere in the room where condensation or leaks could affect cabling or equipment.
- Mechanical, hydraulic or any other services infrastructure routes are not permitted to pass through the communications room in order to service areas outside the room.
- Lighting must meet operational requirements. Natural light is not permitted due to its impact on temperature and humidity control. Windows are strictly prohibited. No exceptions.
- Ventilation must be fully mechanical, compliant with all applicable standards, and sized for occupancy and process loads.
- Positive pressure must be maintained in critical areas to prevent dust and contaminant ingress.
- Smoke detectors or dry fire suppression systems shall be provided.
- Comms rooms shall have a finished, sealed ceiling to maintain a clean, low-particulate environment. Avoid open/exposed ceilings that shed dust. Seal all service penetrations. Target cleanliness aligns with ASHRAE TC 9.9 guidance on particulate contamination risk to ICT equipment. Doorsealing. Fit continuous brush seals ("eyelash") and perimeter compressible fabric/neoprene gaskets to comms-room doors to reduce dust ingress and uncontrolled airflow.

All telecommunications room designs must adhere to the structural and anchoring requirements specified in AS 1170.4, including the use of seismic-rated racks and cable supports. Design documentation must incorporate detailed bracing and anchoring provisions to ensure compliance with seismic performance standards. Coordination with

qualified structural engineers is essential throughout both the design and installation phases to verify structural integrity and ensure alignment with broader building systems.

2.3. Communications Risers Design

The following standards apply to the design of communications risers in UNSW buildings. The final riser location will depend on the architectural design, the location and dimensions of communications rooms, the room layout, the ability to vertically stack risers through all levels, accessibility via public spaces, and the location of other service risers/ducts.

- A single, straight vertical riser must run through the edge of every communications room (in each stack) extending continuously from the lowest to the highest floor.
- Risers and slab penetrations must be sized to accommodate the quantity of communications cables to be installed on construction completion, plus a minimum of 60% spare capacity. More than 60% spare capacity may be required in some circumstances. For example, if the building outlet density is low, there are cold shell spaces to be fitted out later or there is a known requirement for a reasonable quantity of additional future cabling.
- Risers and slab penetrations must be sized to accommodate backbone fibre cabling from building distributor to each floor distributor and telephony cabling from the MDF to each IDF. Horizontal communications cabling is not to be run through floor risers without the written approval of ITCS.
- Conduit penetrations through slabs are acceptable provided the total penetrations are large enough to accommodate all installed cables, and that 60% spare capacity is maintained. The minimum dimensions for risers must be internal and free of columns, ducts or other intrusions into the space.
- Risers must be easily accessible on all floors from slab to slab.
- Risers must be open to the communications room or open via doors or panels onto a public space.
- Risers running within or behind offices, meeting rooms, storerooms or cupboards, labs, teaching rooms, amenities areas, cleaners' rooms or similar spaces are not acceptable. Risers are to be located away from areas where water sources such as sinks, or leaks are likely to run down the communications riser.
- Services other than UNSW AV, voice, data network cabling and cabinets are not to be installed in communications risers without the written authority of ITCS.
- Ensure power and data cable segregation per AS/CA S009 (power vs comms).
- All penetrations to be sealed with AS 1530.4-tested firestopping systems.
- Riser layouts including detailed cable basket sizes and layouts for communications and any other services cable or equipment to be located in the riser are to be provided prior to design confirmation or installation and prior to approval being considered.
- Non ITCS equipment or cabling installed in risers without written authority will be removed at the project cost.
- The dimensions of each riser must be calculated based on the total number of communications outlets and backbone/tie cables required at construction, with additional allowance for the mandated spare capacity to support future growth. Riser sizing cannot receive final ITCS approval until user requirements are reasonably defined. All riser designs must comply with AS/NZS 3084..

2.4. Communications Room Layout Design

This section is to be read in conjunction with Section 2.2 above. The communications room layout design must comply with the design requirements in both sections. A number of design principles are to be applied to the Communications Room Layout. Additional room layout details are provided in Section 6.5.

- Communications cabinets shall be placed in a manner that will allow a minimum of 1 metre clearance from the front and rear mounting surfaces of each cabinet.
- 1 metre clearance is to be provided at the side of the single or ganged cabinets as walk space from the front to the back of the cabinets.
- Where there is more than one cabinet, the cabinets shall be ganged with vertical management hardware to provide inter-bay management. Side panels are usually only required at each end of a ganged assembly.
- Unless otherwise specified by ITCS, cabinets are to be mounted on 123mm high unistrut with 6mm aluminium checker plate lid cover at the rear. The height of the unistrut may vary as it is designed to provide sufficient space underneath the checker plate and cover for all installed cables and capacity for 60% additional cables in the future.
- Quiet-tread, sound-dampening pads shall be installed at all contact points where aluminium checker plate flooring meets Unistrut framing, ensuring no metallic rattle or vibration occurs when walked on.
- All communications cables are to enter the cabinets from below. The checker plate lid is to be cut in 800 x 800 mm segments and incorporate a 20mm hole on each side to allow for ease of removal. Internal supports for the checker plate floor will be constructed using a 21 x 41mm Unistrut cross member.
- The checker plate and supports must be designed in such a way that persons walking on raised floor will not put any stress on cables below nor prevent additional cable installation in the future. Unistrut and checker plate lid normally extend from the back of the cabinets to the riser &/or wall.
- Depending on the communications room design, the cabinets are normally positioned to provide the most direct route from the back of the cabinets under the checker plate to the communications riser. The location of future cabinets and unistrut/checker plate is to be considered during the initial room design.
- Cable basket up the walls is to be used to support cables dropping from high level prior to running under the checker plate to the cabinet.
- Cabling leaving the communications room at high level is to be supported on overhead cable basket.
- Where applicable, the MDF/IDF frame is to be centred between 350mm – 1800mm from floor level with a minimum 900mm clearance in front and 300mm to each side of the frame. This is to be installed in an accessible location within the room that does not block access to the cabinets or riser.
- The CET (Communications Earth Terminal) must be located adjacent to the MDF/IDF, or as otherwise specified by ITCS. The CET installation and bonding arrangements must comply with AS/CA S009:2020 and AS/NZS 3000:2018, ensuring all communications racks, cabinets, cable pathways, and associated metallic infrastructure are correctly bonded to the building's main earthing system.
- All communications cabinets, including Campus, Building, and Floor Distributor cabinet power is to be provided via 2 x 20amp captive outlets supplied from separate, independent power sources, suspended/mounted above each cabinet. At least one captive outlet per

cabinet shall be from a UPS backed source. One double 10-amp GPO for general use is to be wall mounted opposite the front of the cabinets or as specified.

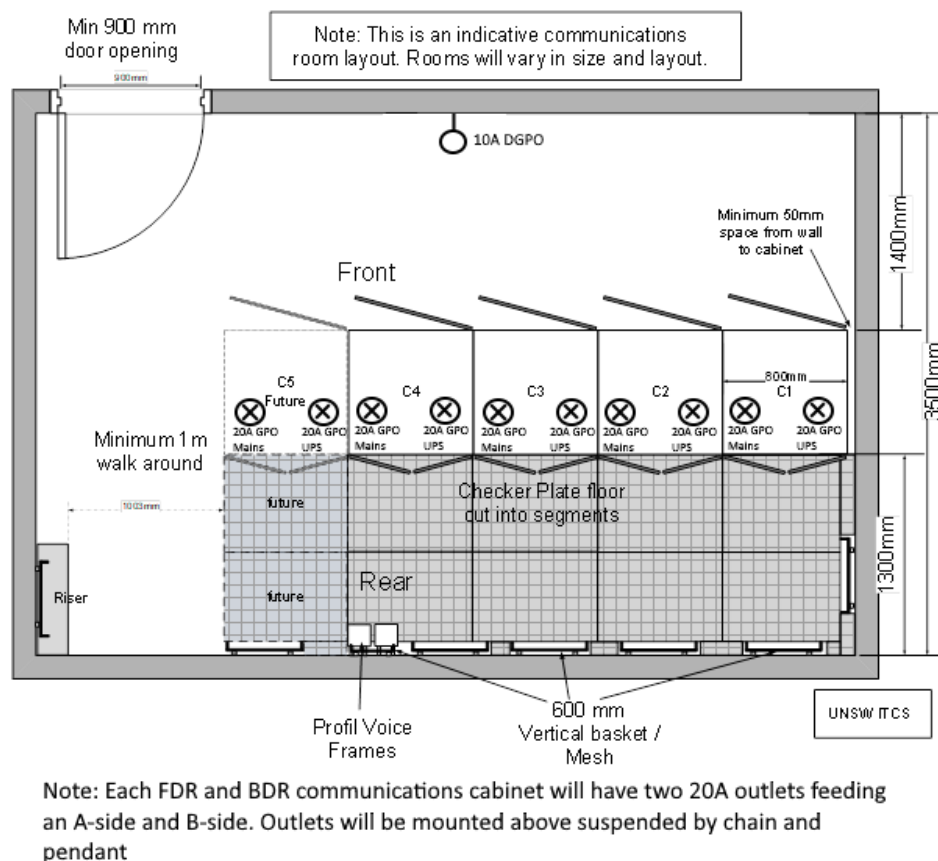


Diagram 1

2.5. Wireless Design Considerations including Ceiling Types

The proliferation of wireless-enabled devices and the increasing reliance on high-performance wireless connectivity across UNSW campuses necessitate a robust and scalable wireless infrastructure. Wireless Access Point (WAP) deployment must be meticulously planned to ensure optimal coverage, capacity, and performance in alignment with the latest UNSW wireless standards and the principles outlined in the "Coverage by Design" framework. This section outlines the design principles, environmental considerations, and installation requirements for wireless infrastructure, including ceiling types and mounting strategies, to support ubiquitous and high-density wireless coverage across diverse campus environments.

The number of wireless access points to be installed is steadily increasing as wireless devices are used for more applications. Staff and especially students use multiple wireless devices simultaneously. The wireless outlet installation design for a new building must match the current UNSW standard by

addressing the specific occupant type, the maximum number of expected user devices and usage patterns within each room. For estimating purposes 1.5 devices per student is to be assumed.

The outlets for the WAPs are to be included in the communications design and installed as part of the construction project. Unless advised otherwise, the wireless access point units are to be installed following construction completion. The wireless design is to adhere to the most recent industry standards. The minimum UNSW standards and general building and technical design principles are listed below. All designs are to meet the following coverage guidelines for the different types of spaces. The classification of each space will be confirmed during detailed design, once the floor plan, the number of occupants and proposed usage has been determined.

Space Classification and Density Guidelines

Wireless design must be tailored to the functional classification of each space:

General Use Spaces may include most office spaces, standard research laboratories, tutorial rooms, corridors, and common areas.

- Density: 1 device per 2.5 m² (or more depending on the space)
- AP spacing: ≤ 20 m

High-Density Spaces may include lecture theatres, student waiting areas outside lecture theatres, high density student study areas, teaching laboratories, and high-density seminar rooms.

- Density: denser than 0.6 people per square metre for 3 devices per person.
- Inter AP spacing: ≤ 15 m
- Capacity: 40–150 simultaneous associations per AP radio

Other types of spaces may include student accommodation, external and special-use areas.

External and Special Use Areas

Wireless coverage must extend to external gathering areas (e.g., terraces, courtyards, steps) with appropriate ruggedised APs (e.g., AP-565). Waterproof housing and elevated mounting are required to minimise attenuation and ensure service continuity.

Student accommodation requires tailored AP models and placement strategies, avoiding hallway-only deployments which compromise RTLS and coverage quality.

Design Principles

Wireless infrastructure shall be designed to meet the following minimum performance criteria:

Signal Strength (RSSI):

- General Use Areas: ≥ –67 dBm
- High-Density Areas: ≥ –62 dBm

Signal-to-Noise Ratio (SNR):

- General Use Areas: ≥ 20 dB
- High-Density Areas: ≥ 25 dB (28 dB preferred)

Noise: ≤ –90 dBm (ideally between –100 dBm and –90 dBm)

Coverage: Seamless indoor and outdoor roaming with predictive survey validation.

Predictive Survey: Occupant profiles (e.g., undergraduate students, academic staff, public users) and device usage patterns must be documented and incorporated into the predictive survey and heatmap analysis.

PoE Connection: All APs to have single ethernet-link and minimum 30W PoE connection to switches. APs in high density spaces should have 60W (unrestricted) & >1Gbps throughput.

Two data outlets shall be provided to each AP location.

The design must consider to IEEE 802.11ax and IEEE 802.3bt for high-power PoE applications, especially for high-density WAP deployments.

Ceiling and Mounting Considerations

Ceiling type and height significantly influence signal propagation and AP accessibility. The following guidelines apply:

Ceiling Height:

- APs must be ceiling-mounted where height is ≤ 5.2 m.
- For heights > 5.2 m, alternative mounting (e.g., suspended rods, wall mounts) must be considered.

Ceiling Type:

- Removable tiles or access panels are required for above-ceiling installations.
- Exposed slabs or bespoke ceilings must be assessed for signal attenuation and access feasibility

Mounting Restrictions:

- Keep APs ≥ 300 mm from metallic services (HVAC ducts, trays), luminaires, cameras, and large reflective surfaces (glass, polished stone). Ensure APs are securely mounted, level, and unobstructed.
- Custom brackets may be required for non-standard environments.

Installation and Documentation Requirements**Wireless infrastructure design and installation must include:**

- Predictive heatmaps and coverage simulations.
- AutoCAD layouts with AP locations, ceiling types, and mounting details.
- Documentation of Wireless Installation Environment (WIE).
- Post-installation validation and remediation of coverage gaps.
- Compliance with Aruba RF Design Guidelines and UNSW RF Implementation Assumptions.

Governance and Change Control

All wireless designs must be reviewed and approved by UNSW ITCS. Any changes during construction must be submitted with marked-up floorplans, justification, and updated environmental documentation. Remediation of black spots is a mandatory project deliverable.

The wireless design must be reviewed and approved by ITCS and is to include the following:

- Floor plans showing the proposed location of each wireless access point outlet & WAP taking into account (and clearly documenting) the wall & ceiling types, the ceiling height and future accessibility as well as the usage characteristics listed below. This information is to be documented as *Wireless Installation Environment* and may be grouped together where identical.
- The expected type of occupant. For example, undergraduate students, postgraduate students, administration staff, academic staff, research staff, public or percentages of each type in a mixed-use room or space.
- Floor plans showing the expected maximum occupant load, expected quantity of devices, application usage for each room.
- Predictive heat maps of the proposed layout.
- The proposed WAP mounting method for each WAP.
- AutoCAD drawings of the final floorplan with the wireless layout are to be provided as soon as available.

- Proof that the deployment requirements have been met is to be provided on completion of the installation. Any remediation to address black spots is to be completed as part of the overall project, including during the defect liability period.

The following guidelines apply to all space types:

- Wireless access point density is not to be averaged across the floor or building. Each wireless access point location will be designed to accommodate the full occupancy load for the immediate area.
- The coverage area includes internal and external to the building, excluding toilets and fire stairs. The coverage requirements for the external WAP design are to be fully investigated and included as part of the overall design. The external WAPs/antennas locations should include provision for waterproof housing as required for mounting the equipment externally.
- Special attention is to be given to the occupancy number and the level of service required for areas where students will gather. For example, external deck areas, external steps, sunny spots in winter, shaded spots in summer, open areas outside lecture theatres or teaching spaces, common seating areas, café locations etc.
- Special consideration is to be given to areas without ceilings such as voids above, or imposed limitations placed on the ability to mount devices under exposed slab or above or below bespoke ceilings that may affect WAP installation, future access or signal propagation. A degraded wireless service due to architectural design elements will not be accepted. Any degradation due to design elements must be remediated prior to project completion.
- Wireless access point outlets are to be placed as close to the service users as reasonably possible.
- Prior to finalisation of the design and installation, consideration is to be given to the height of the proposed mounting position in relation to the service users and the most likely WAP associations; in ceiling infrastructure or anything in the ceilings or walls that may affect signal propagation; ceiling type and future access to WAPs and communications outlets.
- Alternative accessible WAP mounting locations such as walls or under floor may form part of the solution if suitable for efficient signal propagation.
- Areas that are defined as High Density will require special design considerations and are to be investigated to provide the required service level. For high density deployments, antennas may be utilised to direct signal as required.
- All communications outlets and WAPs must be easily accessible following construction completion/installation. They may be mounted above or below ceilings. If above ceiling, access shall be via removable ceiling tiles or access panels.
- WAPs/antennas are not to be mounted against or near metal objects or in close proximity to lights, cameras or other devices that may affect the signal. This includes metal ceiling tiles, mechanical or other metal ducts, polished stone, concrete columns, some glass surfaces or any surface that may affect signal propagation. Minimum 300mm separation from such surfaces or objects shall be achieved at all times.
- WAPs are to be positioned away from clutter, metal objects or any obstructions to signal propagation. Consideration is to be given to the mechanical duct layouts and the ability to mount the WAPs at the nominated location on completion of the construction stage.

- WAP outlets and WAPs must be fixed securely. WAP mounting brackets must be level and secure once fixed in place. In some circumstances custom mounting methods may be required, for example, suspension of the WAP on rods below the slab, custom mounting above or below bespoke ceilings. Architectural approval may be required for surface mounted WAPs.
- A different model of WAP is often installed in student housing/accommodation rooms and the wireless design is to be adjusted to suit.
- UNSW ITCS will supply all Wireless Access Points. If installed prior to building handover, approved contractors will install the WAPs to the UNSW specified standard. UNSW will provide the specific mounting and documentation instructions for the WAPs in consultation with the contractor on receipt of the full wireless design documentation.
- ITCS is to be advised of any changes that occur during construction. To enable adequate review, advice of the WAP and outlet location change is to be accompanied by floor plans with mark ups indicating the previous and the new proposed location as well as the reason for the change. Any change to the installation environment is to be included in the change proposal.

2.6. IBC Mobile Phone Coverage Design

In-building mobile phone coverage infrastructure, typically is not the responsibility of ITCS including Distributed Antenna Systems (DAS), where preliminary coverage surveys deem it necessary, is to be incorporated during major construction works for all new or significantly refurbished buildings.

Carrier Approval: The complete design must be fully compliant with the latest applicable MCF standard and reviewed and approved in writing by a lead carrier nominated by UNSW ITCS. Final approval of the design is subject to ITCS endorsement prior to installation.

Infrastructure Provisioning: Adequate space must be allocated within the building for:

- Cable termination points
- Service providers' active equipment
- DAS riser pathways

Staged Implementation: Projects may opt to install only the DAS infrastructure during initial construction. Upon project completion, mobile coverage will be assessed.

Coverage Assessment Criteria: If post-construction testing confirms consistent coverage of 3 bars or better, measured at -85 dBm or stronger, the installation of active IBC components may be deemed unnecessary. If coverage does not meet the required threshold, full IBC deployment will be mandated.

Budgeting: Where IBC installation is required post-construction, it will be treated as a project cost and must be accommodated within the project's final budget allocation.

2.7. High Bandwidth - Cabling Design

High bandwidth cabling is used to connect devices/equipment which require a dedicated bandwidth of 10Gb or above. The high bandwidth service is to be provided via single mode fibre cores originating from a nominated communications cabinet to outlet/s terminated near the device. The cable design will vary depending on the classification of the device (e.g. meets the criteria for connection to the UNSW High Speed Research Network), the outlet location/s, the quantity of outlets and type of fibre card in the device. All requests for 10Gb connection for a single device are to be referred to ITCS for evaluation and determination of the most appropriate overall design.

As an indication only, the basic design principles within the building may be:

- A single mode fibre tie from dedicated 96c fibre panel in the Building Distributor cabinet to a 96c fibre panel in Cabinet 1 in the Floor Distributor room that serves the section of the building where the device is located.
- A 6-core single mode fibre installation from a dedicated fibre panel in Floor Distributor Cabinet to a location adjacent to the device.
- Variations of the above design may include multicore fibre installation from Floor Distributor Cabinet 1 to a consolidation point within the device room and fibre distribution within the room to a number of devices. Design variations will be assessed and approved on a case-by-case basis by ITCS.

2.8. Internal Building Cable Reticulation Design

All communications cable installation methods must comply with current UNSW standards, relevant Australian Standards, industry best practice, and vendor requirements.

Communications cabling routes are to be installed along corridors and above open, accessible spaces. Cables are to run along the corridor to a point as close as possible to the final termination location. Main cable routes are not to run above occupied spaces such as offices, meeting room, labs, teaching rooms, toilets, cupboards, joinery, storerooms or any rooms where access to any part of the route at any time of day could be restricted.

- Cable reticulation from the nominated communications room must be via wire cable basket (minimum width of 300mm, with side depth 50 mm). This is normally installed above an accessible ceiling but may also be installed in exposed areas where no ceiling exists. Fixed, non-accessible ('lock-in') ceiling types such as plasterboard or sealed metal pan ceilings must not be used along communications cabling pathways. The proposed cable reticulation paths and cable basket sizes are to be submitted to ITCS for written approval prior to materials procurement.
- Where plasterboard or non-accessible bespoke ceilings are specified below any section of a communications cabling route, adequate, easily removable access panels are to be installed every 3 to 4 metres along the entire route with additional access panels at basket intersections and bends or as deemed necessary for future access.
- Wire cable basket is to be installed to support cables in communications rooms and communications risers.
- The wired cable baskets are to be sufficiently sized to accommodate the current cable installation, maximum 55% fill with 45% spare capacity for future expansion. The pathway size will be determined by the quantity and size of cables, the minimum bending radius and allowance for spare capacity. The cables in a pathway shall not exceed the height of the sides.
- Additional spare capacity along cable routes may be required under some circumstances. This will be relevant where the current user requirements for communications outlets is very sparse, there are cold shell spaces to be fitted out in the future or known requirements for a reasonable quantity of additional cabling to some areas in the future.
- Cable pathways are to be installed in dry locations. Proximity to pipes, sinks or wet areas that could result in water egress into a communications room, riser or on to a cable pathway will not be accepted. Pathways are to be installed in neutral, non-fluctuating temperature environments,

not exceeding maximum temperature specified by the cable manufacturer and specified by AS/CA S009

- All parts of an installation shall be adequately protected against damage which might reasonably be expected to result from mechanical injury, exposure to weather, sun, water, excessive dampness, corrosive fumes, accumulation of dust, steam, oil, high temperature, or any other circumstances to which they will be exposed under the conditions of their use.
- Where remote powering (such as PoE) is implemented, installation must meet RP3 (Remote Powering Class 3) with AS/NZS 14763.2 and AS11801.1 to address safety, cable heating, and performance.
- Cable should not be installed in a manner that may cause the maximum operating temperature rating of the cable to be exceeded.
 - Note 1: Cable temperature is the sum of ambient temperature and the temperature rise due to any current feeding through the cable.
 - Note 2: The maximum operating temperature of a Cable should be available from the Cable manufacturer.
 - Note 3: The application of remote powering over new or existing Cabling may cause a Cable to exceed its safe temperature limit, making the Cabling unfit for purpose or hazardous. Consideration should be given, but not limited to, the following—
 - (a) the Cable type;
 - (b) the number of pairs activated in a multi-pair Cable and in a bundle of Cables; and
 - (c) installation factors.
 - Note 4: The Standards Australia Technical Specification SA TS 29125:2019 may provide assistance in determining temperature rise above ambient in a Cable and in Cable bundles, based on the installation environment and Cable construction.
 - Note 5: Temperature rise data for Cable bundles should be available from Cable manufacturers.
 - Please refer to CommScope calculators to be help identify heat and cable length reductions for ambient temperature and report power in accordance with AS/NZS 14763.2 and AS 11801.1. <https://calc.commscope.com/poecalculator.aspx>
- Communications cable basket, conduits, catenary, ducts and any other cable reticulation plant is for the use of UNSW network communications cabling only. Spare conduits are to be labelled at each end "Communications Services only".
- Proposed routes/locations and internal channel sizes for skirting duct, blades, umbilicals or conduit are to be discussed in advance and approved in writing by ITCS. Note: skirting ducts are to be 3 channels unless otherwise advised. For additional information on skirting ducts requirements see Section 6.9.3.
- Consideration is to be given to the additional cable length that may result from reticulation via skirting duct.

- In-slab conduits are to be avoided. If in-slab conduits are proposed, spare capacity is to be specified, and written authorisation must be obtained in advance from ITCS. All in-slab conduits must be clearly marked (including size and entire route) on as-built drawings.
- Cable pathways at drop points and through furniture and joinery must be accessible upon completion of construction and of adequate size for the quantity of cables to be installed, including 60% spare capacity. Provision is to be made for the bend radius throughout the entire route including entry and termination points.

Where exceptional circumstances require the use of an extended reach cable, the University may at its discretion consider the use of extended reach copper solutions (e.g. Commscope Gigareach XL).

The use of such cable is by exception only and each instance must be approved by ITCS in writing.

Private networks

Occasionally, building occupants may request the installation of a standalone internal communications network for specific teaching or research purposes. These private networks will not connect to the wider UNSW communications network and will be treated as a tenant within the development.

- All such proposals must be submitted for ITCS review and written approval before installation, as a full requirements analysis may identify alternative solutions.
- Private cabling infrastructure must be physically separate from UNSW network infrastructure and supported on independent containment.
- Cable colour, outlet colour, baskets, catenaries, and labelling must clearly distinguish the private network from UNSW infrastructure, and must indicate the responsible school, department, or group.
- At no time may a private network connect, bridge, or share cabling or equipment with the UNSW Communications Network.
- Dedicated communications rooms shall be provisioned to support the private networks.
- Dedicated tenant risers and containment shall be provisioned to support the private networks

Refer to Section 6 for additional information on cable reticulation requirements.

2.9. Campus Backbone Cable - Design and Connection to Existing Communications Infrastructure

ITCS is responsible for the approval of design, management, and installation of all communications cabling within the UNSW campus boundaries and maintains the relationship with external telecommunications providers that supply services to UNSW. All engagement with external telecommunications providers must be conducted via authorised ITCS staff unless written authorisation to the contrary is provided by ITCS.

The following provisions apply to the design and implementation of campus backbone cabling within UNSW campuses. Refer to Section 6 of this document for additional details on Campus Backbone cabling:

- External backbone cabling designs must consider the implications for the broader network architecture and operational requirements of the entire campus or sections of the campus as applicable. Backbone cabling designs will always extend, to some extent, beyond the boundaries of the construction site to ensure continuity and resilience of campus-wide services.
- To facilitate the integration of campus backbone fibre ring cables and incoming voice cables, each building must be provisioned with two physically diverse cable routes originating from nominated existing communications pits. A minimum of 2 x 100mm white conduits are to be installed at two separate entry points to the building. Only one of the conduits at each entry is to be used for the initial installation, while the second must remain vacant to support future expansion or redundancy.
- All backbone cabling is to be supported on wire cable basket from the building point of entry to the termination location near the communications cabinet or frame.
- All external fibre and telephony backbone cables must be clearly labelled in accordance with the labelling standards outlined in Section 6.12.
- ITCS retains final authority over the design of all backbone cabling routes and connections to any existing services. ITCS reserves the right to nominate specific contractors to perform cable terminations and related works involving connecting to existing UNSW infrastructure. All telephony jumpering and associated works are to be completed by contractors approved by ITCS.
- Contractors must coordinate with ITCS prior to the installation or removal of any external cabling or associated cabling routes. Builders, contractors or other UNSW departments or groups do not have the authority to access or perform work within any communications rooms, risers or pits without the specific knowledge and authorisation from ITCS for each instance.
- Communications conduits and pits are reserved for communications cabling only. Other services are not authorised to use UNSW ITCS infrastructure.
- UNSW ITCS will nominate the campus backbone fibre ring that will be utilised to support new developments.
- Where the fibre ring does not have sufficient capacity to support a new building, the project shall make allowances to expand the ring with sufficient new fibre infrastructure as advised by UNSW ITCS.

2.10. Building Management Services - Design and Connection to the UNSW Communications Network

A number of building management/monitoring services rely on the UNSW data or voice network for their ongoing operation. As such, the equipment connects to the UNSW communications network and must adhere to the UNSW IT Policy UNSW Data Network Connection Policy - Network Devices and require ITCS written approval prior to implementation

Detailed technical documentation for all services that are to be connected to the UNSW voice or data network must be submitted for written approval by ITCS prior to the design finalisation for that service. This should include Single Line Diagrams that identify all UNSW network connection points and data sheets on control equipment that will connect to the UNSW network. Failure to do so may result in the inability to connect the service to the UNSW communications network. Examples of the Single Line

Diagrams required for review will include but are not limited to Security, BMS, TV, DAS/IBC and AV designs.

ITCS is to be invited to participate in all early AV design meetings to ensure that the AV design principals are compatible with the UNSW data network and assistance can be provided to ensure the design does not breach UNSW IT policy.

Overlay services such as wireless access points (WAPs) must be procured and owned by ITCS; third-party WAPs will not be connected to UNSW infrastructure.

Please note that services designs that require the installation of UNSW supplied devices in proximity to equipment provided by the project are to include the proposed mounting or housing options as part of the initial design. For example, Digital Media Players provided by ITCS to be installed near LCD's, provided and installed by the project.

ITCS will not connect or support third-party devices (e.g. Digital Media Players, wireless access points, or equivalent hardware) supplied outside of approved UNSW procurement guidelines.

Devices that will form part of communications services overlay networks, such as wireless access points will be procured by ITCS.

The project is responsible for the provision of sufficient communications outlets for connection of all required building services and must allow for future expansion in accordance with UNSW design standards.

Equipment of any type that has not been authorised in writing by ITCS is not to be installed in communications rooms.

The project must confirm the expectations of building services providers and system owners (e.g. security, BMS, energy monitoring) regarding continuity of network service during power outages. These requirements must inform project decisions regarding the specification of UPS and/or generator backup capacity for communications equipment.

Refer to Section 3 Submittals for additional information.

2.11. Active Equipment Design & Building Activations

The communications network active equipment will be designed, procured and installed at commissioning stage by ITCS, but may be installed at any point during the Project if deemed necessary by ITCS.

The Project is responsible for providing the occupant and building services requirements information as early as possible to the ITCS team which then forms the basis for the preliminary network active design and equipment procurement.

In addition, a range of information is to be provided and conditions met by the project at various stages for particular network activation categories. Refer to Section 3 Submittals for additional information on the requirements for the Active Equipment Design and the activation categories listed below:

- Builder site shed activations.
- Enabling works and/or ad hoc occupant relocations.
- Building services activation including fire lines and lift phones.

- Communications services, power or mechanical outages.
- Building occupancy relocations/activations.

3. Submittals

A range of submittals are to be provided at different stages during the project. The following sections list the general submittals required by ITCS. Additional or alternative submittals may be applicable for individual projects.

3.1. General Governance

The following general governance submittals are required:

- Commencing at the initial planning stage, provide a list of the governance groups including the names of group participants and project stakeholders, their roles and responsibilities together with the roles and responsibility of the architect, builder, consultants and contractors in terms of their involvement with ITCS and the UNSW communications network. Updated governance groups and responsibilities are to be provided for each subsequent stage.
- Provide all programs/schedules at the time of issue and a list describing the various project meetings so ITCS can elect to attend those that are most relevant to the communications services system.
- The communications plan for the project is to be provided to ITCS to ensure that all communication, reporting channels and escalation paths are clearly defined and agreed from the commencement of the project. All communications to or from ITCS will adhere to the agreed communications plan that has been documented and issued to ITCS at the commencement of the project. Transfer of information to ITCS via a Builder and/or Principal or their authorised representatives does not diminish the responsibility of the Contractor, the Builder and the Principal to provide all information, specifically requested or in any way pertinent to the communications services installation, to ITCS in a timely manner.
- At the commencement of the project, provide a schedule of all design documents & drawings, specifications, samples, shop drawings listing the drawings and the technical data to be submitted for review by ITCS. This list should include the expected date of submission and return for each item. The schedule is to be updated and resubmitted when drawings or documents are added to the list.
- All planning and design documentation is to be submitted for information or review, as developed, to facilitate feedback early in the design process. Designs and/or drawings for any element that affects communications services are to be submitted to ITCS for written approval of the communications services component and resubmitted every time there are changes affecting communications services infrastructure. "For Construction" drawings must be approved by ITCS prior to any work commencing.
- Any proposed deviations from the UNSW Design and Installation Standards and the Project Specification are to be listed and submitted as soon as proposed with the shop drawings if applicable. Where such a list is not provided, the services consultant or contractor will be responsible for full compliance with the standards and specification, irrespective of any review by ITCS.

- All drawings and technical data will be reviewed by ITCS, marked where alterations are requested and returned within 14 working days of receipt unless specified elsewhere or unless the quantity or complexity of documentation received necessitates additional review time or the documentation is received outside the scheduled document review dates. When marked to be resubmitted, the originals are to be amended as required, the parts of the drawing or technical data altered as a consequence of the last revision clouded and resubmitted for review within 14 days of receipt. Wireless layout review may extend beyond 14 working days due to the complexity, volume of information to be evaluated and mapping that may be required.
- All forward labels at field end outlets to switch, switchport, comms room, termination location, building matrix in a CSV or excel file, is to be provided along with the completed as-builts and data floor plans indicating outlet locations.
- All BDR and CDR with smart PDU's installed also need a power cable matrix outlining which PDU port is plugged into which device and device PSU. Additionally the electrical forward label (Db and CB information) per PDU in a CSV or excel file.
- All wireless access points will be provided in an excel or CSV with the following information in separate tabs, standardised, and data cleaned.
 - WAP Installation date
 - WAP make
 - WAP model
 - WAP serial number
 - WAP location (example 'RM 202 west')
 - WAP Ceiling Height,
 - False Ceiling
 - WAP mounted position (Wall/Ceiling/etc)
 - WAP requires OHS accessible equipment (Y/N)
 - WAP requires special access
 - WAP requires Specialist Lab PPE
 - WAP requires security guard escort
 - WAP mounted on (Gyprock/brick/etc).
 - Comments (i.e ladder needed)
-

NOTE: ITCS reserves the right to reset the commencement date of the review for any component of the communications network design if the information provided by the project is not sufficient to enable informed review. ITCS will advise the project if the information provided is insufficient and will restart the review as soon as possible after the information has been resubmitted.

3.2. Architectural Submissions

Initial architectural briefs, concept designs and all subsequent drawings are to be issued to ITCS at the same time as they are issued to the project services consultants and/or UNSW EM. Drawings and specifications as they are updated are to be issued throughout the entire project. As a minimum, ITCS is to receive all documentation and correspondence issued to the Electrical and/or Communications Consultant at the same time as it is issued to the Electrical and/or communications Consultant. It is expected that as a minimum 25%, 50% 75% and 100% drawings will be issued to ITCS and reissued if changed. The type of drawings /documentation should include but is not limited to:

- Design Briefs and any documentation with references to communications services.
- Reference drawings.
- Concept drawings.
- Blocking and stacking drawings.
- Room Data Sheets.
- All User Group information packs at the time of issue, mark-ups and the final version including 1:50 room layouts.
- Concrete profile.
- Elevations.
- Reflected ceiling plans and ceiling schedule.
- Above ceiling coordinated services drawings and coordinated ceiling plans including access panels.
- Sections.
- Wall details.
- General arrangement (including communications rooms and communications and other services risers).
- Specifications.
- FF&E Plan.
- Joinery.
- Office and lab furniture data sheets, including cable reticulation duct type and internal channel size.

3.3. Enabling Works & Occupant Relocation Submissions

A variety of information is to be submitted to enable ITCS to arrange communications relocations or activations of voice and data services for staff, students or UNSW services. For major projects, the preliminary and final active designs for the new building, the building services activations, and the final UNSW occupancy activations are standard components. In addition to these, there are frequently temporary or permanent staff and/or equipment relocations to/from a range of buildings to facilitate the construction or partial building occupation that can occur at any time. The information required by ITCS will vary depending on the stage that the works are to be completed, the condition of the destination location and the permanence of the relocations.

For all relocations/activations, including the final occupancy of the new building, sufficient time is to be scheduled between the building/works handover and UNSW occupation to enable data and telephony activation and testing. Activation and testing includes switch installations and activation; patching and field testing; installation and commissioning of WAPs as required. Failure by the Project to provide sufficient time for communications activations & relocations may result in the failure to deliver services to occupants.

Early Works and ad hoc relocations and cabling works external to the construction site may require separate engagement of ITCS via an IT Service Desk ticket.

The type of information to be submitted to ITCS for enabling works or ad hoc relocations will include, but is not limited to:

- A high-level summary works/relocation program listing the current occupant location/s building floor, room or groups of rooms and the same information for the destination location/s.
- Detailed existing occupant information and the activation requirements at the destination location provided via the ITCS Relocation Form.
- Floor plans including existing outlet numbers with workstation numbers or other information to indicate the exact proposed location of each phone line &/or data activation.
- If new outlets, relocation of outlets and/or equipment or decommissioning of existing outlets form part of the works, the detailed written specification to be issued to the contractor and floor plans are to be provided to ITCS for written approval prior to any work commencing.
- As-built drawings, proof of work completion to UNSW ITCS standards via inspection &/or photos and the final data activation information via the Relocation Form are required at least four weeks in advance of the move. The specified lead time will vary for each project as it will relate to the scale and complexity of the relocations and other scheduled ITCS commitments.
- There are a range of documents and management systems to be updated as a result of any changed or new works in any UNSW buildings and it is possible that UNSW IT Change Approval will be required for the approval of the works.

The lead time for equipment, relocations and additional information on the particular submittals required for this type of work will be provided once the scope of work is defined.

3.4. Communications Structured Cabling Submissions

Submittals are to be issued at suitable project stages and at the same time as issued to other parties to facilitate timely, informed review and approval by ITCS. As a minimum, document issues at 25%, 50%, 75% and 100% are expected. The type of documents includes, but is not limited to:

- Fully detailed Communications Single Line Diagram.
- Line Diagrams for all services requiring connection to the UNSW network. This will include as a minimum Security, AV, BMS, energy monitoring. See Section 2.10 for additional information.
- Outlet mark-up on floor plans with an indication of non-standard outlet locations such as above or below ceiling, Help Points, wall mounted phone handset outlets, floor boxes, wall mounted outlets above 300mm FFL, high bandwidth (fibre) outlets and any external outlets.
- Cabinet elevation layouts including tie cables and the quantity of communications outlets to be installed per cabinet.
- Special occupant requirements – for example a request for an internal network or high bandwidth requirements.
- Communications room layout, including cabinets, riser location and size, MDF/IDF, unistrut/checker plate section, wall & overhead cable basket (size & location), power outlets, other services equipment space requirements, UPS, air conditioning unit (including ducts/pipes), wall mounted GPO and anything else within the communications room.

- Riser layout including size and cable basket size/s for communications services and any other services or structural elements within the riser.
- Proposed cable reticulation including basket sizes and routes, significant catenary routes, proposed conduit or trunking or skirting duct, any proposed in-slab or through slab conduits (identified by type including the reason for that type of route). Extra details as relevant.
- The detailed communications services project specification, brief &/or tender documents at least three weeks prior to general issue to enable review, comment and correction if necessary.
- Reticulation paths through furniture and joinery and the termination location.
- Wireless design documentation. This submittal is to include the following:
 - Floor plans showing the proposed location of each wireless access point outlet/base station; taking into account the wall, wall mounted fixtures, ceiling types, ceiling height and future accessibility as well as usage characteristics as outlined in the following points.
 - Floor plans showing the expected maximum occupant/device load and proposed usage for each room.
 - The expected type of occupant. For example, undergraduate students, post grad students, administration staff, academic staff, research staff, general public or percentages of each type in a mixed-use room or space.
 - Wireless access point mounting method for each WAP. Consideration is to be given to the height of the proposed mounting position, in-ceiling infrastructure or anything in the ceilings or walls that may affect signal propagation, ceiling type and future access to base stations and outlets. Architectural approval may be required for surface mounted base stations if required. For additional information on wireless design refer to Section 2.5.
- Written confirmation of receipt of all ITCS review comments/questions via the agreed project communications plan by the builder/contractor. The drawing/design/brief documentation (with adjusted drawings/documentation if necessary) is to be re-submitted or written notification of the reasons for not following the recommendations provided.
- Notification and details of changes to previously approved designs of any type that affects communications services, the reasons for the proposed change and the resubmittal of documentation for written approval.
- Test results and summaries. The testing requirements and submission details are provided in Section 6.13.
- At least 8 weeks (40 working days) prior to completion/occupation, or earlier if possible, the final, accurate As-Built Drawings on the most recent background with the approved UNSW room numbers clearly visible on the drawings along with test results are to be forwarded directly to ITCS. The marked-up drawing set is to accurately depict the as-built status of the system including:
 - Termination locations.
 - Outlet numbers.

- Cable pathways (including cable basket, high level conduits, beam sleeving, in-slab or through slab conduits, skirting duct or any cable routes concealed from view in joinery or any other location).
 - Conduit/basket size and details of cables carried in conduit.
 - External communications cable routes to the nearest existing pit.
 - Any additional documentation requested by ITCS for a particular project.
- Upon completion of the project, the following is to be provided to ITCS:
 - The Operations & Maintenance Manuals for communications services. The contents of the manuals are to be agreed at the start of the project, but as a minimum shall include:
 - Test results with summaries.
 - Vendor Warranty Certificate
 - Manufacturer's brochures, data sheets.
 - Statements from the communications consultant and the independent commissioning agent, as applicable, confirming that the system has been tested and the installation adheres to the project Specification, the UNSW Design and Installation Standards and Industry and Vendor Standards.
 - Vendor's certification.
 - Internal and external as-built drawings including enabling works, and any other work locations that may be outside the construction footprint.
 - Rack elevation diagrams and patch panel termination schedules (end-to-end cable mapping) - Labelling schema consistent with UNSW standards
 - Single Line Diagram depicting the electrical architecture for the communications rooms back to Main Switchboard.
 - Confirmation that the external communications services as-built drawings have been submitted to UNSW EM for incorporation in the Site Services drawings.

3.5. Samples

Official sign off by ITCS is required for all communications services related materials to be supplied on the project. Physical samples and/or detailed data sheets will be required. These will include, but are not limited to the following:

- Cable basket/wire support / fitting accessories including installation methodologies.
- Cabinets.
- All cable types including telephone, fibre, and copper STP.
- Earthing system bonding equipment.
- All fibre equipment.
- Power Distribution Units
- Wireless Access Points
- Console Servers
- Monitoring Devices
- All cable terminating equipment.
- Horizontal cable management (including skirting ducts)
- Labelling samples.
- Voice associated equipment.

- Aluminium checker plate and unistrut.
- Control equipment data sheets provided by other disciplines (eg. Security, BMS, AV, CCTV) that is to be connected to the UNSW data network.
- Data sheets for desks, workstations, lab benches or similar, indicating cable reticulation and duct sizes.
- Any other materials required to complete the project or as specifically requested by ITCS.

3.6. Active Equipment Design & Procurement Submissions

The active communications network equipment will be designed, procured and installed at commissioning phase of the project by ITCS, but may be installed at any stage of the Project lifecycle if deemed operational necessary by ITCS.

The Project team is responsible for providing comprehensive information regarding the occupant requirements and building services requirements that forms the basis for the preliminary active network design and associated equipment procurement. The confirmed date of the initial data activation within the building (including services activations) is to be provided along with preliminary design information at least sixteen (16) weeks (80 working days) prior to the first activation. Formal approval of the procurement must be provided within two (2) weeks (10 working days) following receipt of the design documentation from ITCS to enable timely ordering of the equipment.

The design and procurement submission must include, but is not limited to, the following:

- The proposed start and completion dates for the initial data activation (typically associated with building services), including staging details if applicable.
- The planned building handover date and the scheduled date of occupation by UNSW.
- Required speed (bandwidth) per outlet.
- Connection type (SMF, RJ45) per outlet.
- Quantity of outlets per communications cabinet, categorised by bandwidth and connection type, including details of the high-speed network requirements with proposed traffic flows.
- The quantity of outlets per communications cabinet to be activated for each type of building service (segmented by VLAN).
- The quantity of each type of outlets per communications cabinet to be activated for the building occupants.

The quantity of wireless access points and other network activations per communications cabinet.

All submitted information will be used to develop the preliminary active network equipment design and to facilitate the subsequent procurement process. Accuracy and completeness of the data are essential to ensure alignment with UNSW's operational standards and to support seamless commissioning and network service activation.

3.7. Building Services Activations Submissions

The detailed building services activation information (Security, BMS, CCTV, FIP, AV etc.) is to be submitted to ITCS at least six (6) weeks prior to the first required services activation date. The following information is required:

- The full communications outlet number (communications room number-cabinet- patch panel-port number), the appropriate VLAN and the field outlet room number are to be provided to ITCS.
- Any special bandwidth, POE or other requirements.
- Provide details for services referenced in Section 6.11, specifically lift emergency phones and help points that require traditional voice services (i.e. cannot operate over IP-based telephony).
- For voice activations, an IT Service Centre ticket is to be submitted by EM with all relevant details. For example, for lift phones, the UNSW lift numbers are to be provided by EM, the location of Help Points and information on voice and data requirements, details of the fire panel location and confirmation that the fire contractor has been engaged for fire line interconnection.

Prior to the UNSW active equipment installation there are several onsite conditions that must be met. These include:

- The communications room and all communications cabinets must be clean, and dust free and maintained to the same standard post-equipment installation. Nearby works that may create dust or other airborne debris are to be closely managed and contained once the equipment is installed. Dust sucked in by the equipment fans can and has caused permanent equipment failure.
- The communications cabling system must be reasonably complete. The outlets to be activated must be terminated, labelled and tested. All external and internal tie cables installed, labelled and tested.
- Permanent power is required, and once UNSW equipment has been installed ITCS is to be notified at least two days in advance via the standard EM power outage notification of all planned power outages. Frequent outages should be avoided and may not be approved once equipment is installed. If frequent outages are required a full shutdown of all equipment for the duration of the works may be necessary.
- The communications room shall have lighting available 24/7 and have sufficient light level for the installation and activation of equipment. Equipment installation will be delayed until sufficient lighting is provided. Refer to AS/NZS 1680.1:2006 and AS/NZS ISO/IEC 14763.2:2020
- There must be a lockable door with access provided to ITCS and general access restricted.
- The communications rooms are to be ready for inspection by ITCS two (2) weeks prior to the agreed date for active equipment installation to provide time for defects rectification and additional cleaning if required.
- Site inductions for ITCS staff at a time that is suitable for most UNSW staff are to be arranged by the builder. ITCS will provide work method statements and insurances upon request.
- The builder is to ensure that there are safe, clear trolley pathways for the delivery of equipment to the site and to each communications room and provide additional assistance for staff on site as required.

See the chart in Section 3.9 below for a summary of common building services activations.

3.8. Building Occupancy Activations Submissions

The practical completion date or the date of the building handover to the Principal, plus the earliest occupancy date is to be provided as soon as available, but must be provided at least sixteen (16) weeks in advance of UNSW staff or student occupation. It will be assumed that all occupant relocations will occur simultaneously unless detailed staging information is provided at this time.

At least eight (8) weeks (40 working days) prior to the first building occupancy by UNSW staff or students, the fully completed ITCS Relocation Form (current version at that time) is to be submitted to ITCS to enable the commencement of the numerous planning, scheduling and detailed work requests required to complete the activation of voice and data occupant requirements throughout the building. If upon review by ITCS, the information on the Relocation Form is found to be incorrect or incomplete, the form will be returned to the project for adjustment and re-submission. The eight (8) week lead time will commence from the date of the final submission of accurate and complete information.

Communications services as-built drawings on the latest architectural backgrounds with the final, official UNSW room numbers and workstation numbers are required at the same time.

Sufficient time is to be scheduled between the building handover and UNSW occupation to enable the equipment installation and activation; patching and activation testing; installation, activation and commissioning of WAPs and sensors as required. As a rule, at least two weeks are required to install, activate, patch and test network connections. The Project is to confirm the start date and duration of the activation period at least 8 weeks prior to occupancy. Failure by the Project to provide sufficient time for communications activations & relocations may result in the failure to deliver services to occupants.

Special Note: All active network equipment is supplied, installed and activated by UNSW IT. All active equipment must be housed in a Communications Room network cabinet. The use of third-party switches, hubs, routers, or any device intended to connect multiple endpoints to the UNSW network is strictly prohibited. Any exceptions must be reviewed and approved by ITCS in writing.

3.9. Summary – Common Network Building Services & Occupant Activation Tasks

Pre-requisites	Responsibility	Lead time
Data network/voice services to builder site sheds		
Engagement: IT Service Desk ticket by EM outlining all requirements prior to submission of the Telecommunications Provider purchase order	Builder via EM	Varies per building size

or initiating any cable installation.

Works:

Varies for each setup. Appropriate forms & advice by ITCS can be provided on request.

Builder/ITCS

Varies

Active Equipment Procurement

Engagement:

Provision of design and procurement information as outlined in Section 3.6.

Builder via EM

Submit to ITCS minimum sixteen (16) weeks prior to first activation.

Works:

- Preliminary active network design
- Approval
- Procurement

ITCS

EM

Varies

Data outlet activation to enable contractors to test building services

Engagement:

IT Service Desk ticket from EM including activation date and required information as per Section 3.7.

Builder via EM

Submit to ITCS minimum six (6) weeks prior to first activation.

Works:

- Campus distributor and internal backbone cabling installed, tested and labelled.
- Services field outlets installed, tested and labelled.
- Communications room/s and defect inspections.
- Approval by ITCS.

Builder

Builder

ITCS

ITCS

-

Two (2) weeks prior to first activation.

As per date requested by builder.

- **Zone switch installation and activation and adequate field switches installed, activated and patched as per the information provided.**

Lift Phone lines (where analogue phone line is required)

Engagement: EM

IT Service Desk ticket, including the UNSW number for each lift marked on floor plan.

Works:

- | | | |
|--|----------------------|--|
| • Campus distributor voice backbone cabling installed, labelled and tested. | Builder | |
| • Lift phone lines setup, jumpering & hotline setup. | ITCS/Lift contractor | Minimum two (2) weeks from engagement, subject to availability of lift contractor. |

Help Points

Engagement: EM

IT Service Desk ticket including the UNSW Help Point number marked on floor plan.

Works:

- | | | |
|---|------------|--|
| • Help Points configured and installed. | Builder | |
| • Help Point LAN connection setup, and patching completed. | Builder/EM | |
| | EM | Minimum two (2) weeks from engagement. |

Interruptions to Communications Services in any existing UNSW occupied areas

Engagement:

Written notification of the proposed services interruption via IT Service Desk ticket.

Builder to EM/ITCS

Required Information:

- | | | |
|--|---------|----------------------------------|
| <ul style="list-style-type: none"> Proposed date, time and duration of the service outage. The exact services affected by location. Impacted user groups. Detailed job specification & work method statements as required. | Builder | Minimum 2 weeks prior to outage. |
| | Builder | |
| | EM | |
| | Builder | |

Once approved in writing by ITCS:

ITCS

Builder/ EM

- The proposed outage notification that will be issued to impacted users.
- Confirmation of IT Change Request submission and approval.
- Active network changes as required.

ITCS

ITCS

Planned Building Power or Mechanical Outage (Post installation of UNSW active equipment)

Engagement:

- | | | |
|---|---------|---------------------------------|
| <ul style="list-style-type: none"> Notify UNSW EM of power or mechanical outage start and finish date and times. UNSW EM to issue standard power outage notification and notify ITCS PMs. | Builder | Minimum 2 days prior to outage. |
| | EM | |

**EM to issue
mechanical outage
notification to ITCS
PMs.**

**Building Occupancy Data
Activations**

Engagement:

**IT Service Desk ticket
from EM including the
first occupant activation
date and information as
per Section 3.8. above.**

Builder via EM

Submit the date of the first occupant and duration allowed for activation to ITCS sixteen (16) weeks prior to first activation.

Works:

- **Assumption: All cabling works complete and handed over, as-builts & test results provided, WAPs installed prior to handover or arrangements for later installation agreed.**
- **Completed ITCS Relocation Form submitted.**

Builder via EM

EM

At least eight (8) weeks prior to the first occupancy.

ITCS

- Detailed active network design based on Relocation Form information.
- Installation plan commenced. Schedule and resources confirmed.
- Processing of data information to enable documentation, activation planning and work orders.

Commence approximately two (2) weeks prior to first occupancy

ITCS

Equipment setup & installation, patching, and testing of field activations.

4. Standard of Compliance

All works shall comply with the current rules and regulations established by the Australian Communications and Media Authority (ACMA), relevant Building Regulations and Codes, and any other statutory authorities with jurisdiction over the installation. All installation practices, materials and equipment shall comply with the latest requirements issued by ACMA, the Standards Association of Australia (SAA), and the applicable *Vendors Certification Program*. The latest versions of the following standards and all attached 'normative addendums' shall be complied with unless otherwise specified:

Standard Name	Description
AS/CA S008	Requirements for authorized cabling products
AS/CA S009	Installation requirements for customer cabling (wiring rules)
AS/NZS 3000-	SAA Electrical Wiring Rules
AS/NZS 3084	Telecommunications Pathways and Spaces for commercial buildings
AS 11801.1	Generic cabling for customer premises, General requirements (ISO/IEC 11801-1)
AS 11801.2	Information technology—Generic cabling for customer premises, Office Premises (ISO/IEC 11801-2)
AS 11801.3	Information technology—Generic cabling for customer premises, Industrial Premises (ISO/IEC 11801-3)
AS 11801.5	Information technology—Generic cabling for customer premises, Data Centre Premises (ISO/IEC 11801-5)
AS 11801.6	Information technology—Generic cabling for customer premises, Distributed Building Services (ISO/IEC 11801-6)
AS 3085.1	Administration of communications cabling systems Part 1: Basic requirements
AS/NZS 4117	Surge Protective Devices for Telecommunication Applications
ISO/IEC 14763.1	Information technology – Implementation and operation of customer premises cabling – Part 1: Administration
AS/NZS 14763.2	Information technology - Implementation and operation of customer premises cabling Planning and installation (ISO/IEC 14763-2:2020)
AS/NZS 14763.3	Implementation and Operation of customer premises cabling – Part 3: Acceptance for Optical Fibre Cabling
AS/NZS 14763.4	Information technology - Implementation and operation of customer premises cabling Measurement of end-to-end (E2E) links, modular plug terminated links (MPTLs) and direct attach cabling (ISO/IEC 14763-4)
AS/NZS 2053.8	Conduits and fittings for electrical installations Flexible conduits and fittings of metal or composite material
AS 30129	Information technology - Telecommunications bonding networks for buildings and other structures

AS/NZS IEC 61935.1	Testing of Balanced Communications Cabling In Accordance with ISO/IEC 11801 – Part 1: Installed Cabling
AS/NZS 2967	Optical fibre communication cabling systems safety
AS/NZS ISO 9001	Quality Management systems
AS/NZS IEC 60825.1	Safety of Laser Products - Part 1: Equipment classification and requirements
SA TS 29125	Information technology — Telecommunications cabling requirements for remote powering of terminal equipment (SA TS 29125:2019)
AS 4262.1	Telecommunication overvoltages, Part 1: Protection of persons
AS 4262.2	Telecommunication overvoltages, Part 2: Protection of equipment
EIA-310D	Cabinets and 19" Equipment frames
Power	IEEE 802.3af, at, bt (PoE, PoEP, 4PPoE)
BCA	Building Code of Australia
ASHRAE TC 9.9	ASHRAE TC 9.9 (Technical Committee 9.9)
Communications Design & Installation Standards	UNSW Communications Services Design & Installation Standards (most recent version).
The Project Specification	The communications specification prepared specifically for the project.

Any variations or conflicts that may occur between documents are to be raised and resolved prior to the commencement of works.

The installation, workmanship, materials and equipment of the entire Cabling System - from patch panel to wall outlet - must comply with the current standard for Cable Performance specified in performance requirements of AS/NZS S009, AS/NZS 3084 and ISO/IEC 11801. The contractor must also adhere to the Vendors Installation Guidelines.

It is a mandatory requirement that the supervisor or leading person of the communications contractor or sub-contractor engaged by any party to perform work on any UNSW campuses meets with ITCS to review the final Specification or design documentation to resolve any uncertainties by either party prior to commencement of work on site.

5. Contractor Workmanship

This section covers information for contractors and sub-contractors in regard to the supply, installation and certification of work involved in the UNSW Communications Networks as part of the overall project.

The contractor will comply with relevant Work Health and Safety legislation and UNSW, Builder or any other site induction requirements. Work method statements, insurance information and other documentation are to be provided upon request by ITCS or other authorities associated with the Project. Where legislation is not applicable, risk management procedures, codes of practice or relevant standards are to be used to mitigate risk to a low and/or normally acceptable level. The contractor is to ensure that the health and safety of employees, visitors and contractors is not adversely affected by the installer work activities.

Safe Work Method Statements (SWMS), insurance details, and other documentation must be provided upon request by ITCS or other project authorities. The entire data communications project is to be covered by the Vendors Certification Program and 25 year warranty. The contractor is responsible for notifying the vendor and arranging regular inspections throughout the project. As a minimum, vendor inspections at construction stages 30%, 60%, 90% and 100% are expected. Vendor inspection reports are to be provided to ITCS when issued. At the completion of a project and prior to acceptance by ITCS, the contractor is to supply a copy of required certifying documentation, including test results. Where a warranty certificate cannot be supplied due to time constraints, a guarantee of warranty is to be acknowledged by the vendor.

It is mandatory that the supervisor/leading hand of the communications contractor/s engaged by any party to work on any UNSW campus meets with ITCS to review the final Specification or design documents to clarify any uncertainties by either party prior to commencement of work on site.

All staff must hold appropriate certifications for the work being undertaken, including ACMA registration and relevant vendor certifications.

ITCS is to be advised in writing if the primary communications contractor plans to engage sub-contractors to perform any part of the communications installation. ITCS may elect to meet with the sub-contractor and will provide written approval prior to their commencing work on site.

UNSW IT reserves the right to request removal of any site supervisor or worker who fails to perform duties in the best interests of the project. Replacement staff must be provided without delay to the installation program.

These general requirements shall be read as supplementary to the general conditions of the construction contract. Conflict or inconsistency between UNSW Communications Services Design & Installation Standards and contract clauses are to be reported to the Project for resolution.

The activities and deliverables outlined in this document represent the minimum services required to successfully deliver the project. The contractor should be familiar with and adhere to all sections of the UNSW Communications Services Design & Installation Standards and all industry and vendor standards. It is expected that the contractor will undertake all necessary activities to deliver works to the satisfaction of ITCS. For example, the following associated activities form part of the works:

- Forming of penetrations if required and not provided by the builder for the passage of cables.
- Sealing of penetrations after the installation of cables using the materials approved by the relevant authorities.
- Making good after chasing conduit into walls and/or floors.
- Co-operation and co-ordination with the builder and other services working on site.
- Provision of all necessary temporary scaffolding, framing and other supports required for the works.
- Removal of all surplus materials, scaffolding, temp covers, protective coatings, rubbish and markings on completion of works.

Approval or acceptance by ITCS of proposals, drawings, samples, modifications or deviations will in no way relieve the contractor of their responsibility for the quality of materials, standard of workmanship,

error in their installation or other contractual responsibilities. Any modifications from those specified shall be submitted in writing to ITCS for approval. All materials, equipment and proposals shall be approved by ITCS in writing before commencement of ordering, fabrication or installation. It is the responsibility of the contractor to ensure equipment and materials offered meet the requirements of the relevant Authority.

All work must be completed to a high standard in accordance with:

- Section 4 of this document (UNSW workmanship standards).
- AS/CA S009:2020 (Installation requirements for customer cabling).
- AS/NZS 3000:2018 (Wiring Rules).
- AS/NZS ISO/IEC 14763 series (Planning, installation, and operation of cabling).
- Current vendor standards and codes of practice.

Where documentation conflicts, the highest applicable standard must be applied.

Approval by ITCS of drawings, proposals, samples, or modifications does not relieve the contractor of responsibility for quality, accuracy, or compliance.

The contractor shall be responsible for the provision of all necessary materials, equipment, tools and labour in connection with the supply, installation, inspection, labelling, testing, certification and report/drawing generation unless advised otherwise.

The materials and equipment listed and contained within the UNSW Communications Services Design & Installation Standards are approved by ITCS and shall be used in all installations for the UNSW network unless otherwise stated. Installation or use of materials and equipment other than those listed or approved will be regarded as unsatisfactory and may result in unconditional rejection. Contractors shall carry out all necessary remedial work or replacement at their own expense without delay to the installation progress for any item of work rejected by ITCS.

- Approved materials are listed in Section 6 of this document.
- Equivalents are unlikely to be approved, but in the exception will only be allowed with prior written ITCS approval.
- Samples of any other materials and equipment not listed are to be submitted, together with technical details, to ITCS for approval.
- The use of ITCS approved materials and equipment in all installations shall in no way relieve the contractor's responsibility for complying with the ITCS specification for the project and industry and vendor's standards.

All work is to be conducted by staff working with a suitably qualified supervisor. The supervisor will co-ordinate all site matters until all works are successfully handed over to ITCS. As a primary communication channel, the supervisor shall represent the contractor on site and within meetings. Staff must be suitably qualified for the work being undertaken and also hold current applicable certifications - Vendor / ACMA. The ratio of fully certified contractors to apprentices is to meet or exceed the Vendor's standards at all times.

Throughout the project, the contractor is to adhere to the communication and reporting channels documented in the main contract for that project. Transfer of information to ITCS via a Builder and/or Principal or their authorised representative does not diminish the responsibility of the Contractor, the Builder and the Principal to provide all information, specifically requested or in any way pertinent to the communications installation, to ITCS in a timely manner.

Professional workmanship, correct materials and proper site co-ordination are essential. All work carried out will be completed to a high standard in accordance with Section 4 of this document as well as industry and vendor standards. Wherever a Standard or Code of Practice is referred to, it will imply the latest issue and/or revision applicable at the time of tender. If there is a conflict between documentation the highest standard is to be applied.

It is expected that the contractor will coordinate the works with all trades to ensure equipment being installed by that trade does not restrict operation, maintenance or service access to equipment installed under these works. Coordination will also ensure that other existing services infrastructure are not affected by communications services installations, other services required for the installation and ongoing operation of the communications network are provided and are able to be maintained and that sufficient communications outlets for other trades equipment are located appropriately.

Some works and or provisions associated with communications services shall be performed by other trades. Liaison with other trades is required to ensure that all requirements are provided for the completeness and proper operations of the communications system.

The contractor will be responsible for the accuracy of all installations, materials, dimensions, setting out and equipment supplied and installed for the UNSW communications network. Whenever there are variations or gaps in the information provided by any discipline, the contractor will submit information or drawings to enable resolution prior to installation. Any queries concerning these or other details shall be directed to ITCS via the agreed communications channels for the particular project. Under no circumstances is the contractor to make decisions regarding the variation of installation method, materials, equipment, setting out or any other component affecting the communications services installation or operation.

No work will be covered up or put out of view without the approval of ITCS. ITCS will be given advance notice to examine any work that will be covered up. ITCS reserves the right to reject any part of the work not complying with the specification or not having ITCS' approval. The contractor will carry out remedial work or replacement of any item of works rejected by ITCS at their own expense without delay to the installation program.

The contractor is to refer to the communications and overall project specifications for site location and special site conditions. Work schedules must be submitted to ITCS for co-ordination of alterations/decommissioning of existing communications systems and the commissioning of the installed system.

All materials and equipment shall be stored on site in accordance with the manufacturer's recommendation. Equipment or component parts of equipment designed to operate in normal room conditions shall be stored at the site with suitable weatherproof and dustproof protection. All materials, equipment and/or work either finished or unfinished shall be properly protected at the site against dust, dirt, paint, the elements and any unauthorised interference or other causes of damage until such time as the finished work has been taken over by ITCS.

In the case of equipment or materials being damaged or stolen, the contractor shall be responsible for the replacement of such equipment or materials at his own cost to match the installation program.

UNSW IT reserves the right to recommend removal of the site supervisor and/or any sub-ordinates from the site should they fail to perform their duties in the best interest of the overall project. Replacement of staff removed under the above conditions will occur without delay to the installation program.

6. Materials & Installation

The nominated contractor is expected to supply all materials unless otherwise advised in writing by ITCS. The contractor will specify the materials tendered as a part of their tender submission. The materials list below describes the mandatory items to be supplied and installed.

All materials must meet Industry standards and the requirements detailed in this document.

6.1. Cabinets and Enclosures

All cabinet installations will be carried out by the contractor. Unless otherwise specified by ITCS, the cabinets will be CRS **45RU** as listed in Appendix 7.2:

6.2. UNSW Reserved Cable Colours

UNSW EM has issued a list of required cable colours for each service that applies to all installations on UNSW campuses. For example, communications STP cable is blue, other services such as Security, building management services, etc have UNSW designated colour coding.

Please refer to UNSW EM Design Guidelines for information on the approved colours for EM related services.

6.2.1. Twisted Pair cable colour

The following table lists the ITCS Reserved cable colours for patch leads (patching within cabinets):

Service Type	Colour
Data Service	Blue
Analogue Voice and Carrier NBN Services	White
Wireless Service	Orange

Management	Green
Console	Brown

6.3. Communications Room Layout

6.3.1. Cabinets & Cabling

- Cabinets shall be placed in a manner that will allow a minimum of 1 metre clearance from the front and rear mounting surfaces with a minimum of 1 metre walk around space at the side of the cabinet/s.
- Where there is more than one rack, the racks shall be ganged with vertical management hardware to provide inter-bay management. Side panels are usually only required at each end of a ganged assembly.
- Side panels must be easily removable and replaceable with a key action. Internal clips are not acceptable.
- Sufficient cabinets are to be installed to provide a minimum of 45% spare cabinet capacity in every communications room based on the maximum cabinet fill as specified within the current ITCS standards. In some instances, additional space for additional cabinet/s or spare capacity within the installed cabinets may be required.
- Unless otherwise specified by ITCS, cabinets are to be mounted on a minimum 123mm unistrut with a 6mm aluminium checker plate lid cover at the rear. All communications cables are to enter the cabinets from below. The height of the unistrut may vary as it is designed to provide sufficient space underneath the checker plate and cover for all installed cables and 60% spare capacity additional cables in the future.
- The checker plate lid is to be cut in 800 x 800 mm segments and incorporate a 20mm hole on each side to allow for ease of removal. Internal supports for the checker plate floor will be constructed using a 21 x 41mm Unistrut cross member.
- The checker plate and supports must be designed in such a way that persons walking on raised floor will not put any stress on the cables below. Unistrut and checker plate lid normally extend from the back of the cabinets to the riser &/or wall.
- Depending on the Communications Room design, the cabinets are normally positioned to provide the most direct route from the back of the cabinets under the checker plate to the communications riser. The location of future cabinets and unistrut/checker plate is to be considered during the initial room design.
- Vertical cable basket/tray is to be used to support cables dropping from high level prior to running under the checker plate to the cabinet.
- All vertical cable trays in communications rooms are to be mounted on 21mm x 41mm unistrut.
- Cabling leaving the communications room at high level is to be supported on overhead cable basket.
- The MDF/IDF frame is to be centred between 350mm – 1800mm from floor level with a minimum 900mm clearance in front and 300mm to each side of the frame. This is to be installed in an accessible location within the room that does not block access to the cabinets or riser.
- Services other than UNSW voice, AV, security, data network cabling, cabinets and wall mounted equipment are not to be installed in communications rooms or communications

risers without the written prior approval of ITCS. Equipment or items installed without written authority will be removed at the project cost.

- The exact space requirements for other services cabling &/or equipment must be incorporated into the overall communications room size and layout submission prior to ITCS considering installation approval. If other services installations have been approved by ITCS, separate cabinets, wall space, baskets, trays, power and riser space as specified in the approval is to be provided for those services. If the requirements for the other services changes for any reason, the revised requirements are to be resubmitted for approval prior to installation. ITCS reserves the right to reject initial requests or subsequent changes.
- Cabinet power is to be provided via captive outlets suspended/mounted above each cabinet via pendant and chain outlet. Each cabinet is fed by two PDU's, of which are fed by a UPS and separate MAINS DB.
- It is preferred that UPS equipment is housed in a central location outside the communications rooms. However, if there is no alternative to housing the UPS in the room, the equipment is not to be housed within communications cabinets. Separate appropriate housing is required. The size of UPS equipment is to be considered as part of the design process and additional space provided within the room. UPS equipment placement is not to encroach on the minimum clearance around communications cabinets. UNSW EM is the approving authority for UPS/generator systems and are also responsible for all ongoing maintenance/replacement as required.
- The communications room layout is to include cabinets, MDF/IDF, overhead & wall cable basket, air conditioning unit, air conditioning pipes, lighting, power outlets (wall and above cabinets), CET location, unistrut/checker plate layout, any other building services cabling, infrastructure or equipment space requirements, including UPS and distribution boards if installed inside the room.
- Cabinets installed on wheels are not acceptable.
- All cabinet railings should be recessed to allow for deep vertical cable management (approximately 155mm).
- Rear vertical rails are to be installed in all cabinets.
- Ceiling tiles are not to be installed in communications rooms. Exposed cable trays are to be installed.
- All room surfaces including ceiling are to be sealed prior to the installation of the communications cabinets.

For additional information on the communications room layout design see Sections 2.2 and 2.4 above.

6.3.2. Active Equipment

Active network equipment required for services testing shall be provided during the commissioning phase by ITCS, but may be installed at any stage during the Project lifecycle if operationally necessary. Active equipment intended for general building occupants will be installed following formal handover to the Principal.

All active network equipment is to be supplied, installed and commissioned by ITCS. All active equipment will be hosted within designated communications room network cabinets. Third-party switches, hubs,

routers, or any equipment designed to provide network connectivity onto the UNSW network for more than one device is not permitted. It is a mandatory requirement that all contractors responsible for installing building services requiring connection to the UNSW data network must first seek formal approval from ITCS.

6.3.3. Power

Two dedicated 20 Amp captive outlets are to be installed above each communications cabinet. Captive outlets are typically suspended from the slab using a Clipsal pendant-style General Purpose Outlet (GPO) or a Clipsal 56 type outlet mounted directly to a unistrut running along the length of the ganged cabinets. Regardless of the method used, the captive outlets must be installed no higher than 400mm above the top housing of the cabinet. In addition, a wall-mounted double GPO shall be flush-mounted on the wall directly in front of the cabinet row for general-purpose use:

Each cabinet is to be provisioned with 2 x 20A captive outlets, connected via separate electrical feeds and/or distribution boards to ensure power redundancy.

For all new building projects, each cabinet must include at least one power-feed sourced from a centralised UPS system, unless otherwise specified by ITCS.

Where a building generator is included in the project scope, the power provisioning design must ensure that all communications racks are appropriately sized to maintain operational continuity and accommodate IT workloads during power outages.

6.3.4. Cooling

A comprehensive thermal load assessment is to be performed for all communications rooms. The assessment should include but is not limited to, the following:

- Evaluation of the total heat output generated by all installed and anticipated future network and active equipment.
- Inclusion of redundancy considerations and peak operational load scenarios.
- Verification that the cooling system is appropriately sized to meet the projected thermal load, and implement effective airflow management to maintain consistent environmental conditions.

All communications rooms must:

- Maintain ambient room temperature between 18°C and 27°C, in accordance with ASHRAE TC 9.9 recommendations.
- Maintain relative humidity between 40% and 60% and non-condensing.

CDRs and BDR's must be equipped with a minimum of N+1 cooling redundancy to ensure operational continuity under fault or maintenance conditions.

Within FDRs, a dedicated exhaust system to provide backup cooling may be provided in lieu of a N+1 redundant cooling system. In failure mode only, elevated temperatures within ASHRAE allowable temperature ranges may be accepted (15°C-32°C).

6.3.5. Environmental Monitoring

To ensure the operational integrity and longevity of active network infrastructure, important communications rooms—including Campus Distribution Rooms (CDRs) and Building Distribution Rooms (BDRs)—must be equipped with comprehensive environmental monitoring systems. These systems are essential for maintaining optimal conditions and enabling proactive response to environmental anomalies.

Monitoring Requirements

Environmental monitoring systems must be capable of continuously tracking and reporting the following parameters:

Ambient Temperature:

Real-time monitoring with alert thresholds aligned to ASHRAE TC 9.9 recommendations (18°C to 27°C).

Relative Humidity:

Continuous measurement with alert thresholds between 40% and 60%, and non-condensing.

Water Leak Detection (applicable to new CDR rooms):

Water leak detection systems shall be installed in all newly constructed Campus Distribution Rooms (CDRs). Sensors must be installed at floor level or near HVAC condensate lines to detect water leaks and to provide timely alerts to enable rapid response and mitigation of any leaks.

System Integration and Reporting

All environmental monitoring systems must be integrated with ITCS's central Environmental Monitoring Appliance or equivalent platform.

Alerts and threshold breaches must be configured to promptly notify ITCS and UNSW Estate Management, enabling timely response and effective mitigation of identified issues.

Historical data logging must be enabled for trend analysis and compliance auditing.

Redundancy and Resilience

Monitoring systems must remain operational during power outages via UPS backup.

All monitoring equipment must be installed in accordance with AS/NZS 3000 and AS/NZS 3084 standards.

Commissioning and Maintenance

Environmental monitoring systems must be commissioned and validated prior to handover.

Routine maintenance and calibration schedules must be documented and adhered to, with records retained for audit purposes.

6.3.6. Checker Plate Floor Design

The aluminium lid is to be cut in 800 x 800 mm segments and incorporate a 20mm hole on each side to allow ease of removal. Internal supports for the checker plate floor will be constructed using a 21 x 41mm Unistrut cross member. Threaded rod or similar supports will be established to support the cross members and checker plate lid. Special note shall be taken that all lid segments have a minimum of 3mm clearance from surrounding solid surfaces to allow removal.

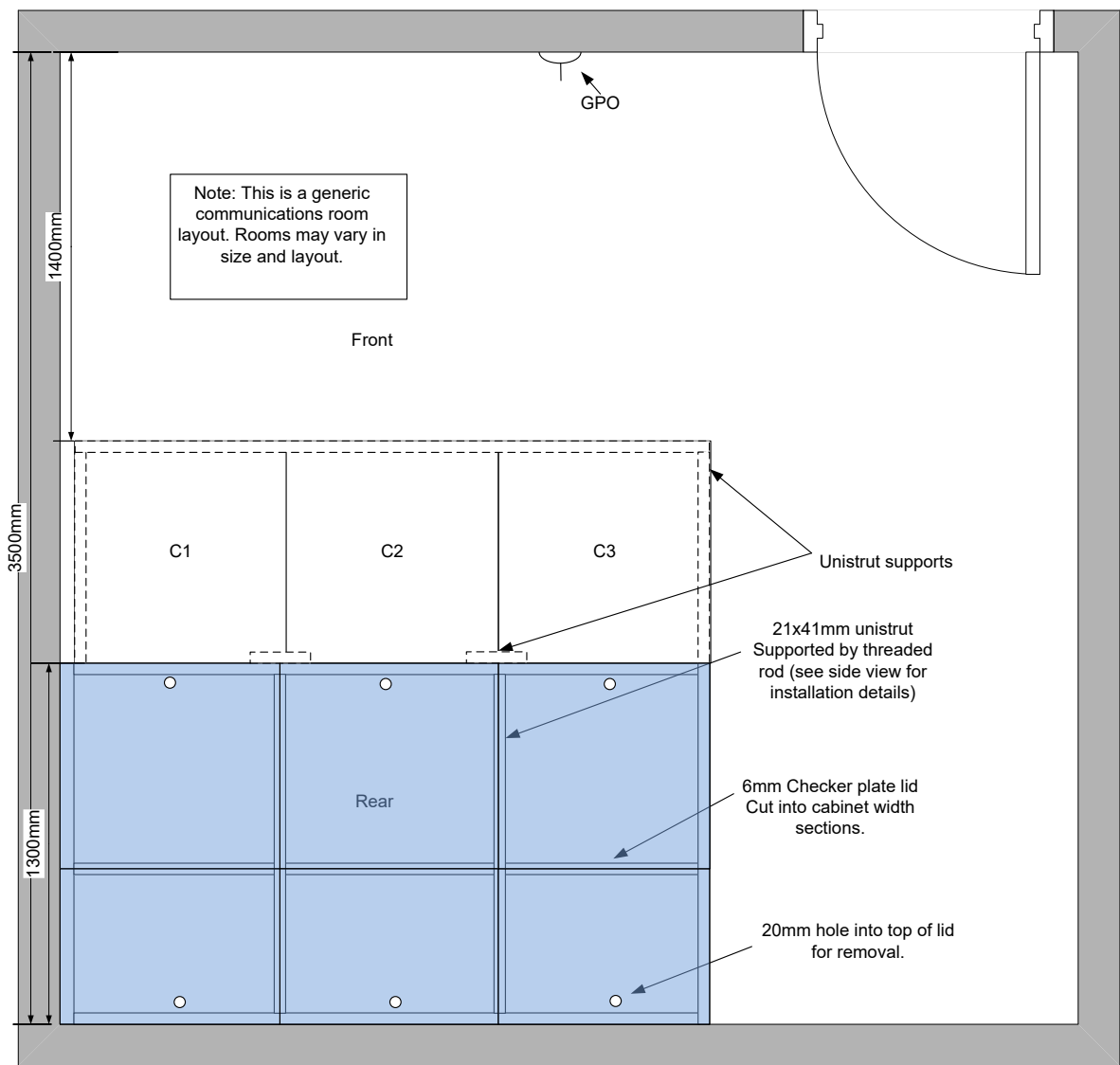
If a checker plate floor is to be installed directly upon entry to a communications room, a small ramp commencing from the door to the edge of the raised floor is to be built.

The checker plate and supports must be designed in such a way that persons walking on raised floor will not put any stress on cables below. Unistrut and checker plate lid normally extend from the back of the cabinets to the riser &/or wall.

Be sure to use sound deadening squares at points of contact to dampen aluminium rattle at contact points where the plates meet the cross members.

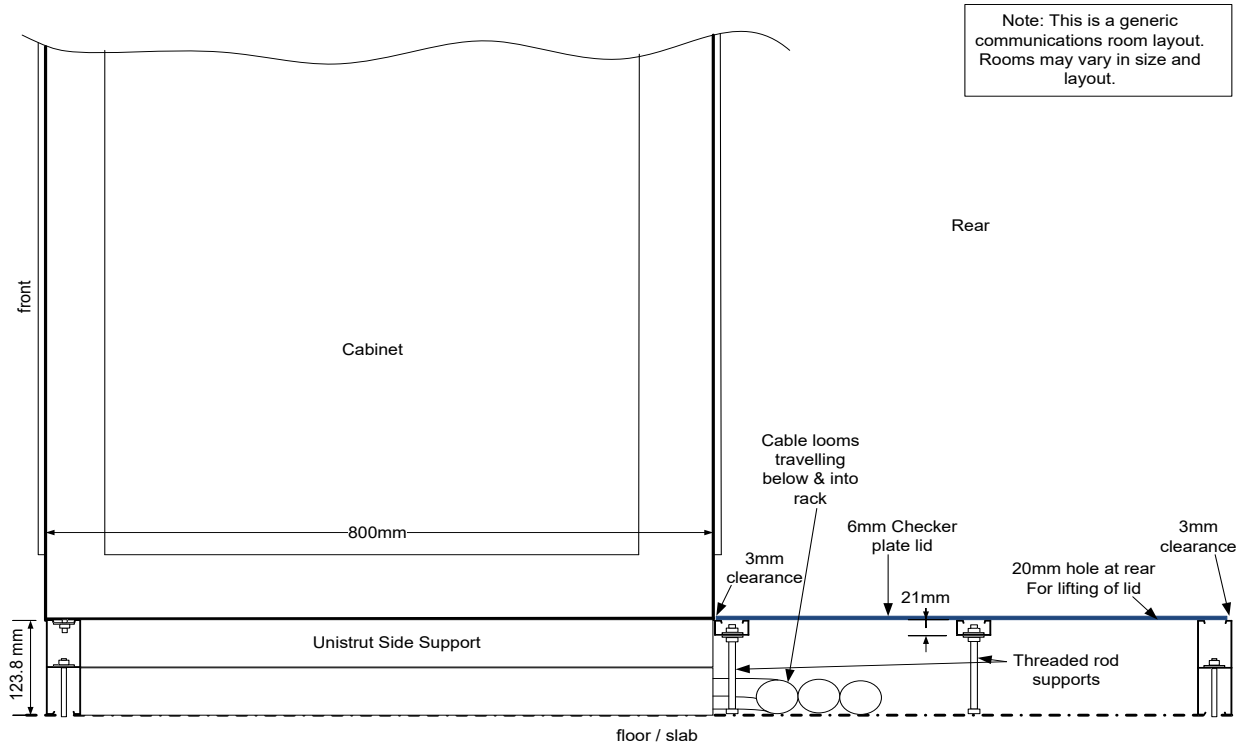
Diagrams 1, 2,3, & 4 below illustrate the checker plate floor design within communications rooms.

Generic communications room layout.



UNSW
ITCS

Diagram 1

Side View Underfloor cabinet design for 123.8 mm Unistrut**Diagram 2****Diagram 3**

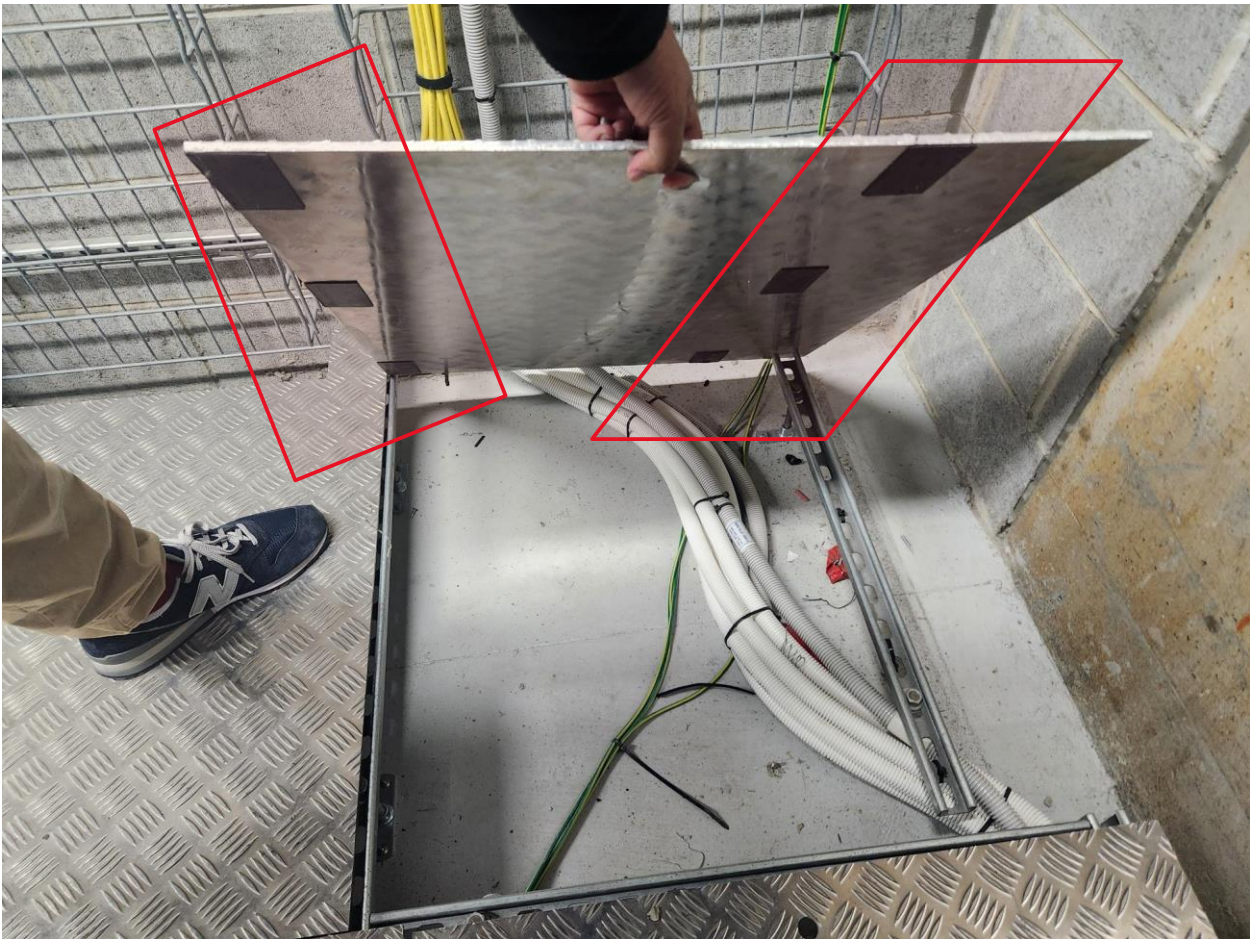


Diagram 4

6.3.7. Cabinet Configuration & Indicative Cabinet Layout

- All patch panels and patch cable supports shall be installed inside an equipment cabinet in accordance with the cabinet layout specifications provided by ITCS.
- All termination equipment and ring runs shall be mechanically secured inside the cabinet using appropriate brackets, adaptors, fixing screws, and cage nuts supplied for the installation.
- All cabinets shall be securely affixed to their supporting structure to ensure stability and compliance with safety standards.
- Two dedicated 20A power circuits must be provided as detailed in Section 6.5.3 Power.
- Sufficient cable loom should be allowed to enable movement of the patch panels and fibre panels within the cabinet, provided that cable is within length limits. Cabling inside the cabinets shall be loomed and run around the periphery of the cabinet. A J-Bend or U-bend is an acceptable method of cable installation at the cabinet end.
- As a minimum requirement, fibre panels must have sufficient loom to allow removal from the cabinet to a work surface positioned directly in front of the cabinet, so additional terminations can be completed. Due to the potential volume of cable looms, the appropriate cable management method for each installation should be discussed and agreed upon with ITCS on-site prior to installation.
- Cable baskets or equivalent supporting systems shall be used to organise cables, with appropriate cable Velcro straps employed to prevent strain on the cables due to gravitational pull. Looms should be positioned to avoid obstructing the installation of any further 19-inch rack mounted equipment.

- All cables shall be dressed and terminated in accordance with ISO/IEC11801, the certifying body's recommendations, and recognised industry best practices.
- All communications cabinets are to be labelled on the cabinet frame (not on the door). For labelling specifications, refer to Section 6.12 Labelling.
- The current standard CRS cabinets are 46RU with 45RU available for use. The RU numbering provided by the manufacturer should start at RU2, ie. RU1 is not numbered and RU2 is numbered as 1. Any deviation from this convention must be communicated to ITCS prior to installation. Special note shall be taken to ensure termination equipment is installed at the correct RU position within the cabinet. For a typical Floor Distributor cabinet layout, refer to *Diagram 4*.

Typical Floor Distributor Cabinet Layout

RU	Floor Distributor Cabinet
	Spare RU space - Empty
1	Deep Ring Run (DRR)
2	Fibre Panel
3	STP Tie (if required)
4	DRR
5	KOMBO Switch (Supplied by UNSW ITCS)
6	DRR
7	48 Port Switch 7 (Supplied by UNSW ITCS)
8	DRR
9	48 Port Switch 6 (Supplied by UNSW ITCS)
10	DRR
11	48 Port Switch 5 (Supplied by UNSW ITCS)
12	DRR
13	48 Port Switch 4 (Supplied by UNSW ITCS)
14	DRR
15	48 Port Switch 3 (Supplied by UNSW ITCS)
16	DRR
17	48 Port Switch 2 (Supplied by UNSW ITCS)
18	DRR
19	48 Port Switch 1 (Supplied by UNSW ITCS)
20	DRR
21	Horizontal Cabling Patch Panel 1 (PP#)
22	PP2
23	DRR
24	PP3
25	PP4
26	DRR
27	PP5
28	PP6
29	DRR
30	PP7
31	PP8
32	DRR
33	PP9
34	PP10 (Design limit)
35	
36	
37	
38	DRR
39	VP3
40	DRR
41	VP2
42	DRR
43	Voice Panel 1 (VP#)
44	DRR
45	Empty

Diagram 4

Note: The Building Distributor Cabinet Layout will vary depending on the specific requirements of each project and is not the same as the standard Floor Distributor Cabinet layout. A specific Building Distributor

Cabinet layout approved by ITCS is to be provided for each project. Additionally, the layout of Cabinet 1 within each Floor Distributor may be adjusted to accommodate HSRN requirements.

6.3.8. Earthing – CES

A CES is a dual-purpose communications earthing system used for both functional and protective purposes. The external sheath to this conductor is to have yellow/green insulation. A CET is the terminal that the earthing system connects to within the communications room.

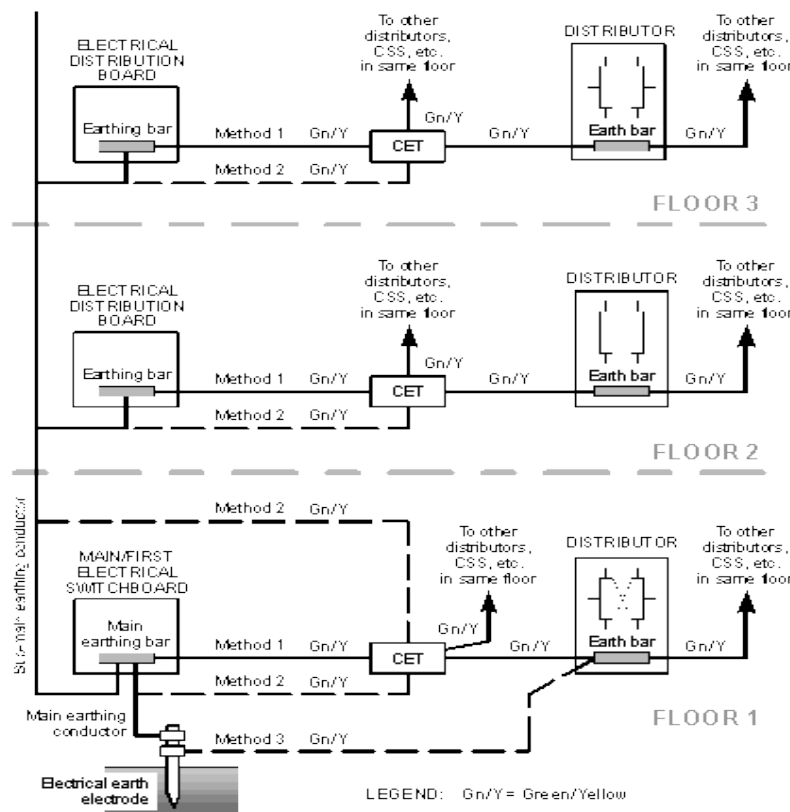
Frames of all metal casing which include equipment chassis, enclosures, raised metal floors and cable trays shall be adequately earthed. Earthing stud termination shall be provided for connection to the earth system. Earth protective conductor size and maximum resistance shall be in accordance with AS/CA S009 - AS/NZ3000 and be installed in accordance with best industry practices.

The earthing system shall be designed and/or approved by a qualified Professional Engineer, licensed in the state that the work is to be performed. Installation and termination of the CET to the building service entrance earth, at a minimum, shall be performed by a licensed electrical contractor.

The CET shall be installed in an easily accessible location and preferably adjacent to the voice vertical cable tray within the communications room. The CET shall be labelled adhering to the AS/CA S009 standard.

In accordance with local and national regulations, the protective and functional earth bond label is required 150mm to 300mm from both ends.

Typical CES/CET for commercial premises with distributed cabling (source figure 1, Wiring Rules AS/CA S009: 2013)



Special note shall be taken when earthing the shielded copper cabling system. Shielded systems require all metal components including the patch panel connected to the CES.

6.3.9. Console Servers - Out of Band (OOB) Infrastructure

Provide resilient OOB access for network and infrastructure in and new CDR and BDR spaces, not applicable to FDR spaces.

- a) On-campus cabinets shall use **Opengear OM1208-8E** (8 x RJ-45 RS-232 and embedded 8-port GbE switch).
- b) Off-site/remote cabinets shall use **Opengear OM1208-8E-L** (as above, with integrated LTE-A for cellular OOB). Off-site equipment shall be enrolled to Lighthouse for centralised management.
- c) Provide dual power feeds to the console server (A/B) aligned to cabinet PDU diversity (see Section 6.5.3).
- d) Hard-wire up to eight critical devices (switches, routers, firewalls) to serial ports; label both ends with device hostname and port mapping.
- e) Where cellular is deployed (OM1208-8E-L), install LTE antennae per manufacturer guidance to meet acceptable RSRP/RSRQ targets; mount in the comms room with adequate separation from metallic obstructions.
- f) Opengear devices are to come with relevant 5-year Foundation 8x5 Support, off-site locations must have Lighthouse Core 5-year subscription.

6.3.10. Captive Outlets & PDU Standard

Each CDR cabinet and BDR cabinet holding active critical infrastructure shall have an Enlogic Smart PDU EN6325-xxxxxx and be served by two captive outlets (one per PDU), fed from diverse sources: ideally one (A) utility/mains and one (B) UPS backed source. Where UPS diversity is not available, circuits shall be separate, independently protected, and on different RCD/MCB poles and boards. Diversity is mandatory.

PDU models & captive plugs. Standardise on Enlogic EN6325 (Outlet-Metered, Outlet-Switched iPDU, 200–240 VAC, single-phase, 20x C13 + 4x C19). Select captive plug to suit circuit rating:

- EN6325-56P315 (15 A flat pin captive plug)
- EN6325-56P320 (20 A round pin captive plug)
- EN6325-56P332 (32 A round pin captive plug)

Mating outlets — Clipsal 56 Series (IP66):

- 56P315 (15 A, 250 V, 3 flat pins)
- 56P320 (20 A, 250 V, 3 round pins)
- 56P332 (32 A, 250 V, 3 round pins)

PDU's are to be mounted to each cabinet vertically, tidied cable management for all connected devices and input power to the PDU.

6.3.11. Wireless User Experience Insight

Deploy Aruba User Experience Insight (UXI) G-Series Ethernet + Wi-Fi 6 sensor (R7H75A) in 'areas of high traffic and sensitivity', for example: Student examination rooms, meeting points, and other expected high-density areas.

Include 3-year UXI cloud subscription (R4W98AAE-1), mount 1.5m from floor height and within coverage of the production wireless SSIDs and provide structured cabling and patching back to a PoE enabled switch.

6.4. Communications Riser Layout

- A single, straight vertical riser is to run through the edge of every Communications Room (in each stack) from the lowest to the highest floor.
- Risers and slab penetrations must be sized to accommodate the quantity of communications cables to be installed on construction completion, plus a minimum of 45% spare capacity. More than 45% spare capacity may be required in some circumstances. For example, if there are cold shell spaces to be fitted out later or there is a known requirement for a reasonable quantity of additional cabling in the near future.
- Conduit penetrations through the slab are acceptable as long as the overall penetrations provided are of sufficient size to accommodate all installed cables and sufficient penetrations and conduits are provided for 45% spare capacity.
- The minimum dimensions for risers must be internal and free of columns, ducts or other intrusions into the space.

- Pipes, ducts and other services cabling are not to enter or pass through communications risers.
- Cables are to be supported via cable basket of sufficient size (including spare capacity) that is to be installed within the riser.
- Risers must be easily accessible on all floors from slab to slab.
- Risers must be open into the communications room or open via doors or panels onto a public space if there is no communications room on that floor. For example, if communications rooms are on alternating floors, the riser on the floor without the communications room must open on to a public space, such as a corridor or open area. Risers running within or behind offices, store rooms or cupboards, labs, teaching rooms, amenities areas, cleaners' rooms or similar spaces are not acceptable. Risers should be located away from areas where water sources such as sinks or leaks are likely to run down the communications riser.
- Services other than UNSW voice and data network cabling and cabinets are not to be installed in communications rooms or communications risers without the written authority of ITCS.
- Riser layouts, including detailed cable basket sizes and layouts for communications and any other services cable or equipment to be located in the riser are to be provided prior to approval being considered and prior to design confirmation or installation.
- Non ITCS equipment or cabling installed without written authority will be removed at the project cost.
- The size of each riser is directly related to the number of communications outlets to be installed during construction and the required spare capacity for the future. Therefore, they cannot be fully approved by ITCS until there is a reasonable understanding of the occupant's communications services requirements.
- Riser sizes must adhere to AS/NZS 3084 and UNSW Communications Services Design & Installation Standards.
- Cable installation within risers is to adhere to all industry, vendor and ITCS standards as outlined in this document and in the particular project Specifications/Brief.

6.5. Campus Backbone Route Installation

Construction of a new building typically requires the installation of two physically diverse external cable routes. These routes shall extend from existing communications pits to newly constructed pits positioned just outside the building, and from there subsequently into the building's communications infrastructure. In addition to these standard short-distance routes, certain projects may require the installation of extended or remote cable routes to support broader connectivity requirements.

Installation of new communications routes must be clearly defined within the project Specifications. Written approval from ITCS is required prior to the finalisation of design or commencement of installation for any new external communications routes.

As a general principle, in addition to meeting the engineering and operational requirements to ensure the routes and pits are fit for purpose, the following guidelines are to be followed:

- All new external communications routes are to be comprehensively documented and submitted to ITCS and UNSW EM for formal review and written approval.

- All communications conduits are to be white in colour and have a minimum size of 100mm. Multiple 100mm conduits may be required depending on capacity and redundancy requirements.
- A draw rope is to be left in every conduit to facilitate future cable installation.
- If a depth has not been specified, the minimum depth from the ground surface to the top of the conduit is 300mm in non-trafficable areas, and 500mm for trafficable areas.
- Off-road areas where vehicles may mount kerbs or where ride-on mowers are used is considered trafficable. If in doubt, trafficable-rated pits and lids are to be installed.
- Pits are not to be installed on UNSW roadways or in any location that will necessitate partial road closures when opened or expose staff working in/near the pit to increased risk.
- Trenches shall be backfilled with fine sand, such that the sand provides a minimum 100mm bedding around the entire circumference of the installed conduit, and ACMA-approved PVC marker tape is to be laid on top of the sand prior to filling in the trench (minimum 150mm above conduit).
- Trenches will be restored by filling and compacting, all surfaces restored to original condition.
- Class D Pits and pit lids are required in trafficable areas. Pits and pit lids are to be suitable for the location and pits and pit lids sized appropriately.
- Pit lids (especially concrete filled) are to be no larger than 900mm x 450mm and preferably 450mm x 450mm. Exact dimensions may vary depending on the site-specific requirements.
- To allow drainage of the pit, drainage holes shall be provided and the pit shall be bedded on 100mm of fine sand a layer of permeable, durable, underlay 150mm of gravel.
- When installing small pits, all conduits will enter the through the ends (sides with the shortest walls).
- All open trenches should be guarded using approved safety barriers to ensure site safety.
- As-built drawings are to be submitted to ITCS and to UNSW EM on completion. The drawings should include the location of the route, conduit depth, number and size of installed conduits, pit locations and dimensions.
- UNSW Estate Management is responsible for updating & issuing the revised Site Services drawings to ITCS for review and record-keeping.

6.6. Campus Backbone Cabling System

ITCS is responsible for the design, management, and installation of all communications cabling within UNSW campus boundaries. ITCS also maintains formal relationships with external telecommunications providers that supply services to UNSW. All engagement with external telecommunications providers must be conducted through authorised ITCS staff, unless written authority to the contrary is granted by ITCS. If works by one or more external telecommunications providers are required, there could be a lead time of several months and must be factored into project planning.

There is an existing, extensive UNSW communications voice and data campus-wide backbone cabling infrastructure system installed throughout Kensington campus and extending to other UNSW campuses, hospitals and affiliated organisations.

At UNSW Kensington Campus, there are multiple fibre rings comprised of 48-core or 144-core OS1 or OS2 fibre with yellow sheathing. Refer to Section 6 for materials specifications.

- Contractors must coordinate with ITCS prior to the installation or removal of any campus backbone cabling. Builders, contractors, and other UNSW departments or groups do not have the authority to access or perform work within any communications rooms, risers, conduits, or pits without the specific knowledge and approval from ITCS for each instance.
- Communications conduits and pits are reserved for communications cabling only. Other services are not authorised to use communications services infrastructure.
- Campus backbone cabling must be installed within designated communications conduits and pits (whether existing or newly installed as part of the project).
- It is the responsibility of the contractor to verify the suitability of the proposed cable route and pits for the requirements of the project, the condition of the conduits and pits, and the availability of spare capacity for future installations. If the conduits or pits will be close to capacity upon completion of the project, this must be reported to ITCS during the design stage and prior to commencement of works.
- External voice cable ties will generally reticulate from one of the campus distribution locations to the building distribution point via existing in ground pits and conduits to a location near the construction site.
- New external fibre cable ties will generally be integrated into an existing fibre ring serving multiple buildings if there is sufficient capacity. The specific fibre ring, cable path, and patch/splice through design, as well as impacts on other buildings serviced by the fibre ring will vary for each project and the detailed design and staging information must be outlined in the project Specification.
- To accommodate the campus backbone fibre ring cables and incoming voice services to each building, two physically diverse cable routes from nominated existing communications pits are to be provided to the building. A minimum of 2 x 100mm white conduits are to be installed for each of the two entry points to the building. Only one of the conduits at each entry is to be used for the initial installation, and the second conduit is to remain vacant for future use. Please note that the dimension of pit lids is to be limited to enable easy access in the future.
- Consideration is to be given to the prevention of possible flooding through pits and conduits entering the building. As well as to temporary conduit blocks at the pit and at the end of the conduit inside the building, every effort should be made to angle the conduits upward from the external pit as they enter the building.
- UNSW Facilities site induction, detailed designs, work method statements, and written approval from ITCS are required prior to any work involving the voice or data Campus Distributors or any communications rooms outside the defined limits of the construction project.
- All backbone cabling is to be supported on wire cable baskets from the building point of entry to the wall near the terminating communications cabinet or frame in the building distributor room.
- A 15-metre cable loop is to be coiled and secured high on the wall of the terminating communications room. The exact location of the coil is to be approved by ITCS.
- The following labelling or similar shall be fixed along the fibre cable routes at regular spacing within the ceiling and floor space, and at building entry/exit points:



- In-ground conduits carrying any form of fibre cable shall have the following label tape installed directly above the conduit:



- All external fibre and telephone backbone cables are to have an additional label and/or identification plate attached to cables within the source communications room, at the point of exit from the source building, at every external pit along the route, within the conduit or pit just outside the destination building, and at the nearest visible location just inside the destination building. Labelling is to include the following:

From " <u>Building Name</u> " - Room "# " – To " <u>Building Name</u> " - Room "#"
Type (Single Mode or Multi Mode and Make) & Core count
Installed by : " <u>your Company name</u> "

Refer to Labelling Section 6.12 for detailed labelling information.

- ITCS retains final design authority over all backbone cabling routes and connections to any existing services. UNSW reserves the right to nominate specific contractors to perform cable terminations connecting to existing UNSW infrastructure. All telephony line jumpering and associated works are to be completed by contractors nominated by ITCS.
- Installations of campus backbone cabling must adhere to all applicable industry standards, vendor specifications, and ITCS standards as outlined in Section 4.

6.7. Internal Building Backbone & Floor Cabling System

The following requirements apply to the installation of all STP wiring and fibre cabling to the desktop as well as the internal STP, telephony, and fibre tie connections:

In general, the floor cabling system shall utilise Category 6A as a minimum, star-wired horizontal cabling with RJ45 outlets, and possibly supplemented by some fibre outlets to the desktop. The building backbone shall utilise both Category 6A cabling and single-mode fibre cabling. The specific cables to be installed are detailed in Section 6 - Materials.

All data communications installations, including UNSW connections within a retail tenancy, is to be covered by the Vendors Certification 25-year warranty. Prior to completion of each project, all test results along with the warranty certificate shall be presented to ITCS for review and approval.

6.7.1. Backbone Cabling Requirements

All backbone cabling between the Building Distribution Room(s) (BDR) and Floor Distribution Rooms (FDR) shall be provided using OS2 single-mode optical fibre (SMOF) only. No copper backbone cabling is required.

Where the building is served by a single BDR, each FDR rack shall be provided with a minimum of one (1) 24-core single-mode optical fibre (24C SMOF) backbone cable, home-run directly to the BDR.

Where the building is served by two (2) BDRs, each FDR rack shall be provided with a minimum of two (2) 12-core single-mode optical fibre (12C SMOF) backbone cables, with one home-run to each BDR. The two backbone routes shall be physically diverse, following separate and independent pathways.

Backbone cabling shall be routed via vertically aligned communications risers and shall terminate only within the designated BDR and FDR racks.

6.7.2. Cable Routes

It is the Consultant's/Contractor's responsibility to propose feasible cable routes for the current and future cable runs between patch panel and wall outlets and to comply with vendor standards and the maximum fill ratios specified for cable runs in this document.

Pinch points, route congestion with other services infrastructure and any restrictions on access to communications infrastructure along all routes should be eliminated during the design stage. It is an industry and UNSW requirement that communications cabling is accessible along the entire route on completion of the project.

Cable routes are to be installed along corridors and above open public spaces. Main routes are not to be installed above occupied spaces such as offices, meeting room, labs, teaching rooms, rest rooms, cupboards, joinery, store rooms, kitchens or bars or any rooms where access to any part of the route at any time of day could be restricted.

The proposed cable routes and proposed access panels as required shall be submitted to ITCS for written approval before the installation commences.

The contractor is to adhere to the following installation standards in conjunction with the industry and vendor standards listed in Section 4.

- Maximum design link (excluding patch leads) for STP is 90 meters at 20°C and 82 meters at 40°C. (See vendors Installation Guidelines for Separation on Heating Sources).
- As a rule of thumb the measured length on the plan should not be greater than 65m. This allows for the inevitable route variations that occur during construction.
- Any concerns regarding route lengths that may exceed 90m after installation must be raised prior to the commencement of the project. Any subsequent problems with route length will be the responsibility of the contractor to rectify at their expense.
- Communications cables shall only reticulate via dedicated risers, cable basket, catenaries, duct channel and conduits.
- As per AS/NZ3084, communications cabling is to be installed only on the support infrastructure designed for the task. It is not permitted to use supports intended for other services just as no other services are permitted to use the cable basket or other pathways and spaces nominated for communications cabling.
- Non-communications network cabling (including, but not limited to Security, CCTV, DAS, BMS, MATV, fire, occupant's standalone communications network cabling) shall reticulate via separate suitably sized basket, catenaries and conduits. They will not utilise infrastructure support systems allocated for ITCS and will not be installed in UNSW IT network cabinets or communications rooms.
- Backbone cabling is to be clearly separated from horizontal cabling when installing on the same cable basket.
- All points of cable entry, supporting frame, etc. shall be free of burrs or other obtrusions so as to prevent damage to the cable insulation or conductors.
- The maximum number of cables in a bundle on a catenary wire shall not exceed 1 x loom of 24 cables for Cat 6A.
- Where diverse cable paths are required, it is the contractor's responsibility to ensure the use of alternate routes for all cabling infrastructure. A minimum of 5m separation between primary and secondary paths shall be maintained at all times. Consideration is to be given to the maximum cable length for copper cabling.
- Cabling is to reticulate along the cable basket to the point closest to the outlet termination. Cable support is to be provided where the cabling leaves the basket and the cable is to be supported via catenary to the final drop point.
- Minimum separation between communication cable (pathways) and non-electrical hazardous services shall not be less than 100mm.
- STP cables running in parallel with power cables of any kind, shall comply with current Standards of Practice. Cable routes should avoid devices such as fluorescent lights, cameras or plant equipment.
- Lift shafts shall not be used as a cable path.
- Ladder trays are not acceptable for communications cabling.
- Mesh or wire trays with crossbars greater than 100mm are not permitted.
- Cable pathways shall be independent of any other service and/or support.
- Cable supports such as cable baskets and catenaries shall be supported in accordance with manufacturer's instructions using recommended accessories.
- The maximum fill of wire baskets at initial install shall not exceed 40% and must be rated to support the expected cable load

- Minimum clearance between the top of cable trays/mesh tray (wire basket) and other objects / surfaces should be 300mm.
- Perimeter pathways and modular furniture pathways fill shall not exceed 40% fill at the initial install, up to a maximum of 50% fill after future additions.
- Pathways shall be installed in dry locations to protect cables from moisture levels above the intended range inside premises.
- Cable routes must be coordinated with other building services during design to avoid clashes and ensure compliance with spatial and access requirements.
- Final cable routes must be documented in the as-built drawings

6.7.3. Cable Wire/Baskets

- It is a UNSW requirement that communications cabling along main routes is reticulated horizontally and vertically throughout the building via suitable wire/mesh basket support with a minimum of 50mm sides. Mesh with crossbars greater than 100mm are not permitted.
- If an alternative cable support method is proposed, the request is to be submitted to ITCS for written approval prior to procurement. The request is to include full technical details and a sample of the alternative product along with the reasons that the alternative has been suggested.
- All vertical cable basket in communications rooms are to be mounted on 21mm x 41mm Unistrut.
- All cut edges of wire baskets must be deburred and fitted with edge protection to prevent cable damage.
- A cable drop out kit must be used where cabling leaves the cable basket to prevent damage to the cabling.
- Reference Tool: Use the <https://calcpathways.commscope.com/> to determine cable tray and conduit fill rates in accordance with AS3084 requirements.

6.7.4. Skirting Duct / Trough

The UNSW standard for communications cable installation within a skirting duct is to use the largest outer channel of a 3-channel duct. The centre channel is generally used for termination. No other services cabling will share the same channel as communications network cabling. A maximum 2 x 90° bends are acceptable in a skirting duct or trough.

The skirting duct must be sized to contain all cables installed at completion of the project plus a minimum allowance for 60% spare capacity.

The number and location of drop points must be suitable for the installation, provide for 60% spare capacity, be fully accessible following construction completion, provide adequate segregation and be constructed such that any disruption to segregations such as gaps or joints between ducts shall be kept to a minimum and shall not exceed 150mm.

Outlets terminated on skirting ducts are to be flush mounted unless otherwise advised. The colour of faceplates and jacks should match the duct colour or colour standards applicable to the project.

Where ducts are concealed or integrated into joinery, access panels must be provided to allow full cable access and maintenance.

6.7.5. Floor Boxes

Cabling to floor boxes shall comply with the manufacturer's specifications and be installed in accordance with AS/CA S009 and relevant industry standards. Floor boxes must be:

- Fit for purpose, supporting the intended load and usage environment.
- Installed with bend radius limits maintained to preserve cable performance and integrity.
- Clearly labelled at all outlet positions in accordance with UNSW labelling conventions and AS/CA S009 requirements.

Indoor Conduit Runs

Unless otherwise specified within the Overall Project, all cables will be installed in white (communications) conduit or an ITCS approved trunking system.

The following shall be observed for all indoor conduit and trunking installations:

- Wherever possible, conduit and trunking installation should be minimized and co-ordinate with other services under the scope of the Overall Project.
- All conduit and trunking runs shall be fixed with an appropriate device (eg. saddles) to walls or ceilings at sufficient spacing so as to prevent sag. Installation of saddles at intervals of 1,000 mm for vertical runs and 600 mm for horizontal runs is considered sufficient spacing for UPVC conduit.
- Conduit and trunking shall be run horizontally and vertically wherever possible and arranged in neat, documented and easily traceable routes.
- Unless otherwise specified, manufacturer standard fittings such as bends, sets, end caps, etc. shall be used.
- Restrict conduit running internally in a building to no more than 30m in a straight, continuous path. Only 2 x 90 ° bends in conduits are acceptable.
- Draw-in boxes and junction boxes shall be used for long conduit runs.
- Conduit and trunking runs requiring penetration of floors or walls in fire rated areas must be sealed with fire rated material approved by the UNSW Facilities Management.
- Space factor for cables running inside conduit shall not exceed 40% of the maximum cross-sectional space of the conduit. AS/CA S009 specifies filling ratio of conduits and troughs.
- Conduits encased in the slab are to be avoided if possible. If in-slab conduits are proposed, they must be approved in writing by ITCS prior to installation. All in-slab conduits must be clearly marked (including size) on as-built drawings.
- If cabling from below is required, the ITCS preference is to run cable from the appropriate communications room servicing the area via the communications riser and reticulation infrastructure on the floor below and then via through slab penetrations to the area to be serviced on the floor above.
- Raised floor cable routes are to be avoided, but may be acceptable in some circumstances. All proposals to install cable routes under a raised floor must be approved in writing by ITCS.
- Conduits and ducts through floors and walls shall extend to a minimum of 100mm above or past the finished surface.
- All cabling running in the ceiling and/or under floor space shall be grouped and supported via cable tray, conduit systems, approved hooks or catenary systems. Unsecured cable runs will be deemed unacceptable.

- All communications conduits shall be clearly labelled with “Communications Conduit” and include the origin and destination of the conduit at each end and at available intervals along the route.

6.7.6. STP Cable Installation

The contractor is to adhere to the following standards in conjunction with the industry and vendor standards listed in Section 4.

- There is no requirement to randomly lay STP cables due to the internal metal sheath.
- Excessive cable compression adversely affects the cable’s characteristics both physically and electrically.
- Cable on mesh trays and catenaries should only be tied to these supports at intervals specified by the vendor’s installation guidelines. As a guide, it is usually recommended that Velcro ties be installed in a randomly spaced fashion.
- Where relevant fastening materials are used for securing looms, the maximum permissible supports allowed will be as per the cable vendor’s maximum quantity.
- Nylon cable ties are not permitted.
- Securing of vertical cabling should be at approximately 500mm increments using approved Velcro fastening at least 10mm wide.
- Each cable run from the patch panel to the wall outlet shall be in one continuous length. No splicing or jointing in any form is allowed.
- No cable stapling/clipping is permitted.
- Follow the vendor’s recommendation on the cable installation bending radiuses. As a guide STP cables will have a minimum bending radius of 60mm (120 mm diameter).
- Minimum bending radius recommended by cable manufacturer shall be strictly observed. To ensure the vendor’s approved bending radius, ITCS recommends the use of conduits at all vertical drops for communications cabling.
- The maximum hauling tension shall not exceed 11kgs for cabling ranging from cat5e –cat7a.
- Cabling that has been subjected to water is to be reported to the ITCS project representative immediately. Appropriate rectification will be advised.
- Fire stop systems shall meet the requirements of the BCA of Australia and shall be approved by UNSW Facilities &/or a qualified Professional Engineer (PE) qualified in the state where the work is to be performed. Any floor penetrating items such as risers, cables, conduit, and wire-ways shall be properly fire stopped.
- Sheathed cabling exposed to water and not completely dried within 24 hours is to be replaced.
- If cable ends or connecting hardware becomes wet for any period, all must all be replaced.
- All fire stop systems shall be installed in accordance with the manufacturer’s recommendations and shall be completely installed and available for inspection by ITCS prior to cabling system acceptance.
- Painting of cables is not permitted.

6.7.7. Fibre Optic Installation

Fibre optic installation standards are to be read in conjunction with all of Section 6.9 as well as relevant industry and vendor standards. A number of single-mode fibre ties are to be installed from the Building

Distributor cabinet(s) to every Floor Distributor cabinet. The exact quantity of fibre ties per floor distributor cabinet will be provided in the project Specification. There may also be a requirement to install one or two-pair fibre outlets to desktop locations throughout the building. Some specific considerations that should be addressed during the installation of optical fibres include:

- Pulling Tension – ensure the manufacturer’s specified pulling load is not exceeded during installation. Failure to do so may cause breakage of the fibres that may not be externally visible if the outer jacket remains intact.
- Minimum Bend Radius – follow the manufacturer’s recommendations. If not provided, the bend radius of indoor cable shall be no less than 20 times the outside diameter during pulling, and not less than 10 times the diameter once installed. The optical fibre bend radius for two and four-fibre indoor cables should be no less than 50mm during pulling and no less than 25mm when installed.
- Compression Avoidance – avoid treading on the cable or exposing it to other forms of compression forces. Localised compression points will cause local increases in insertion loss or cable failure in the future.
- Adequate Support - inadequate protection and support under the minimum bend radius will have the same effect as causing local pressure points. Campus backbone and internal fibre ties should be supported by cable tray. Two or four-pair fibre installations to desktop field locations should be reticulated via cable baskets to the nearest point, then through flexible conduit to the outlet location, or as outlined in the project specification. Reticulation methods may vary depending on site conditions.
- Cable Continuity - Each optical fibre cable shall be in one continuous length. No splicing or jointing (except for the termination ends) of any form is allowed. Minimum bending radius’ recommended by the manufacturer is to be strictly observed.
- Optical Fibre Safety – always assume the fibre cables is active with radiation and handle it with caution, unless personally verified it to be safe. Appropriate safety protocols must be followed at all times.
- All campus and building fibre optic infrastructure installed within the building shall be secured using Velcro straps. The use of cable ties is not permitted.
- All fibre optic cables installed under floors in communications rooms shall be mechanically protected with the use of corrugated conduit, affixed at appropriate intervals. A “Caution” label shall be affixed to identify the underfloor cabling. Refer to Section 6.12 for specific labelling requirements.

6.8. Infrastructure Termination

All cabling Installation and termination shall comply with AS/CA S009, AS /NZS 3084, ISO/IE11801, AS/NZS 3000 and the Vendors Specifications / Guidelines for Copper and Optical fibre cabling.

See Section 6 Materials for item information and Section 6.12 Labelling for labelling details.

6.8.1. Campus Backbone (External) Fibre Optic Cable Termination

The Campus Backbone fibre ring is comprised of 48-core or 144-core OS2 fibre optic cable segments with a yellow sheath and is to be terminated on a Fibrenet Enclosure.

- Detailed splicing, pass-through and coordination information for the particular fibre ring will be provided separately for each project.
- Testing of termination points at every building connected to the fibre ring is required upon completion of cable installation or following any termination changes to any part of the ring.
- Both ends are to be terminated as an LC-LC Connector to ensure optimal signal performance and minimal reflection.
- A 15m of fibre loom shall be coiled and secured on the wall within the Building Distributor room of each building to allow for future maintenance and possible re-termination requirements. The incoming fibres into a Building Distributor room shall be directly connected to the Campus Backbone fibre ring.

6.8.2. Building Backbone (Internal) Fibre Optic Cable Termination

The Building Backbone cable ties from the Building Distributor cabinet(s) to Floor Distributor cabinets is Tight-Buffered indoor / outdoor OS2 riser cable with a yellow sheath.

- At the Building Distributor (lead-in) cabinet, internal fibre ties to each Floor Distributor cabinet shall terminate in a 96-core fibre optic breakout tray. The preferred core reticulation method is illustrated in Image 1.
- At the Floor Distributor cabinets, the internal fibre ties shall terminate in a 48-core fibre optic breakout tray. Refer to the preferred core reticulation method as illustrated in Image 2. The vendor's Installation Guidelines for termination and testing shall be adhered.
- Both ends are to be terminated as Duplex LC connector.
- In the Building Distributor cabinet, the internal fibre ties are to have a 2m fibre loom that is coiled nearby, and positioned outside the cabinet. The appropriate method may vary for each installation and approval by ITCS is required for each installation.
- In the Floor Distributor rooms, a 2m fibre loom is to be installed at the top half of the cabinet's vertical tray (adjacent to switch location) to facilitate accessibility and future maintenance.
- Each cabinet in CDR/BDR/FDR spaces shall include a dedicated fibre tie panel landed to the building backbone (one level up). I.e – all FDR cabinets should have a FTP leading up to the BDR, and BDR cabinets to the CDR. Terminate as LC duplex, single-mode (OS2), factory-polished or fusion-spliced pigtails to TIA-568.3-E compliant hardware.
- Provide minimum spare fibres: 25% or +6 cores (whichever is greater). Each tie panel shall be clearly labelled (Building Code – Rack – Panel – Core range).



Image 1 - 96-core high density fibre optic breakout tray in a Building Distributor cabinet



Image 2 - 48-Core Fibre Optic Breakout tray in a Floor Distributor cabinet

6.8.3. Copper Cable Termination.

- The horizontal copper cabling follows a star topology. All cables must be continuous from the communications room to the work area and to other cabinets.
- All new horizontal cabling must be at minimum CAT6A and shielded if powered devices is to be connected.
- Horizontal cable runs must not exceed 90 metres, with an additional 10 metres allowed for patch cords (total 100m).
- Must be installed in dedicated pathways, avoiding proximity to EMI sources (e.g. electrical cabling, motors)
- Cables must support IEEE 802.3af/at/bt PoE standards, with consideration for bundle heating and derating to ensure PoE Compliance
- ELV/LV cabling must utilise dedicated trays.
- ELV/LV cabling may only share trays with explicit approval by UNSW ITCS. Where ELV/LV cabling share trays, a minimum separation of 300mm from power cables must be maintained at all times unless shielded or separated by barriers.

- Cable pairs shall be terminated in a neat and professional manner using the 568A sequence.
- The sequence of termination of cables on the patch panels shall reflect the sequence of the outlets installed in rooms.
- Each cable shall be clearly labelled on the cable jacket behind the patch panel and field end. AS/3085.1 requires the cables to be labelled 150-300mm from termination.
- Cables labelled within the bundle, where the label is obscured from view shall not be acceptable.
- Excessive jacket removal will cause deterioration in the transmission performance of the balanced pair cable. The amount of jacket removal will be as little as possible.
- Minimum untwist at termination shall not exceed 5mm for Cat6A.
- All cables at their termination ends shall be secured properly so as to prevent strain due to the weight of cable.
- Minimum bend radius of 4x cable diameter to prevent performance degradation.
- Use LSZH (Low Smoke Zero Halogen) or fire-rated cable in risers and plenums as per BCA requirements.
- Work area outlets should be terminated at the same level as power outlets unless advised otherwise. The minimum height for communications outlets is 150 mm above finished floor level.
- Installation of connecting hardware is to meet the EMI separation requirements for cables as stated by AS/CA S009. As a guide, 50mm is a starting point.
- All work area outlets shall be labelled with a unique and acceptable identification label as per the ITCS labelling standard.
- Bend radius of the cable in the termination area shall not exceed the vendor's installation guidelines.
- Communications outlets can be either flush mounted, or if approved, surface mounted type according to the requirements of the Overall Project. All outlets shall be mechanically secured onto the wall or perimeter furniture with appropriate fixing screws. Details concerning exact positioning of outlets will be provided prior to commencement of works. The contractor should not make these decisions under any circumstances.
- Faceplate colours may be specified by the architect. The jack and faceplate is to be the same colour and faceplates on skirting duct are to be a similar colour to the duct unless advised otherwise.
- All installed links must be tested to verify compliance with Cat6A performance standards using a certified field tester, along with any additional testing protocols specified by the vendor.

Patch Panel termination

All Patch panels will be mounted firmly using appropriate fixings supplied in manufacturers packaging. Special note shall be taken to ensure all cable bending radiuses and stress on cables is kept within the vendor's installation limits. Cabling installed within communications cabinets for termination onto patch panels shall be mounted according to the standard cabinet layout defined in this document. The final cabinet layout for each project is to be reviewed and approved by the ITCS project representative prior to the commencement of patch panel terminations.

6.8.4. Voice Panel Termination

Unless otherwise specified, voice panel terminations shall follow a top-to-bottom numerical sequence (e.g. 1–25 top, 26–50 bottom for a second panel). Telephone cabling shall be installed directly from the nominated voice frame to the voice patch panels using 2-wire terminations. The RU location shall be as per the site-specific cabinet layout approved by ITCS.

6.8.5. Voice Frame Termination

- Cables will terminate on Profil frames at CD, BD or FD utilizing IDC Disconnection Modules.
- All cables shall be terminated identically at both ends of the installation.
- Testing will be required to ensure polarity and pair colours are correct.
- Backbone cables will terminate on the left frame, from the bottom up. This frame is usually labelled "A". Where provided, the right frame will house cabinet ties. Where a single vertical "A" is provided, cabinet ties will be terminated above the backbone cable(s).
- UNSW reserves the right to witness any testing of voice cabling.
- All Records will abide by as AS/NZS 3085.1, ISO/IEC11801 and any standard nominated in this document.
- Record Books must be provided and regularly updated at all voice frame locations.

6.8.6. Consolidation Points and MUTOAs

The use of Consolidation Points or MUTOAs is strictly prohibited without written approval from ITCS. Any unauthorised installation will be subject to removal at the project's expense.

6.9. SCC (Special Circumstance Cabling)

6.9.1. Lift Phones

ITCS's preference is for lift phones to utilise a 4G/5G GSM connection.

If a 4G/5G service is not a viable option, Lift Phone cabling will be part of the overall cabling system of a building. Lift Phone cabling shall be un-interrupted from one point to another. Voice cabling for the connection point at the lift is to run to the nearest floor voice connection frame for the floor. The cable/s will terminate on a separate IDC Disconnection module at the top of the designated frame. Reverse labelling to identify both ends of the cable and the lift number is required.

6.9.2. Security Help Points

Security Help Points are part of the campus safety program and these may be located internally or externally.

ITCS requires that all Security Help Points be of the IP-connected type (i.e. non-analogue) and integrated via the standard UNSW Communications Network using Shielded Twisted Pair (STP) cabling. Analogue installations are not permitted unless explicitly approved in writing by ITCS.

The equipment usually includes but is not limited to both security and communications infrastructure. These services are individually installed from their source IDF/ communications cabinet termination location. Daisy chain connection between Help Points is not permitted.

In the event that an IP-connected Security Help Point is not viable, the voice cabling shall terminate at the nearest IDF or MDF for the floor or the building. The cable will terminate on a separate IDC Disconnection module at the top of the designated frame directly below the module for the lift phones.

If data services are required, the STP cable is to run back to the appropriate communications cabinet for that location. Reverse labelling to identify both ends of the cable and the Help Point number if known is required.

Security Help Point devices, locations and security cabling requirements are to be provided by UNSW Security.

6.9.3. Touch Screen/Information Kiosks

Touch Screens or Information Kiosks are sometimes used to provide information or direction for visitors. They are normally located internally at the building entry and are connected via the UNSW Communications Network. The communications outlets for this type of device will connect back to the communications floor cabinet servicing that section of the building.

6.9.4. NBN Services

It is generally the responsibility of the retail tenant to apply for internet connections to service their tenancy. ITCS recommends the use of wireless internet connections over the cellular network wherever possible. Where it is not a viable, tenants may require a service delivered from one of the NBN Points of Presence (in Library and Old Main Buildings on Kensington Campus) to the tenancy. Connections must be provisioned as a VDSL service via the campus voice cabling backbone and riser cabling within the building and patched to the STP horizontal cabling to the tenancy. The NBN NTD shall be located within the tenancy.

All cabling within the retail tenancy, including outlet terminations, should comply with UNSW standards.

6.9.5. Faculty Server Rooms / Computational Clusters

STP and fibre cabling originating from a communications cabinet to a School or Faculty Server Room or Computational Cluster is usually terminated on patch panel/s in one or more server cabinets. Within the communications room cabinet these cables are terminated just like any other wall outlet in the building. All cables to be run to a server room must originate from the same communications floor cabinet. The contractor is not to exceed the maximum quantity of patch panels allowed per cabinet and should consider the space remaining before commencing the installation. UNSW IT staff (Communications Services and the Faculty IT Manager as a minimum) are to be involved in the design process with the building occupants requesting the room. The final proposal for the passive and active design of these rooms must be approved in writing by ITCS prior to approval for construction. Third party switches, hubs, routers or any equipment designed to provide connectivity onto the UNSW network for more than one device is not to be installed in Faculty server rooms. All active network equipment is supplied, installed and activated by ITCS. All active equipment will be located in a communications room network cabinet. Design will be assessed on a case-by-case basis and subject to ITCS approval in writing..

6.9.6. Building Services

A designated number of communications outlets will be required to support various building services. It is the responsibility of each service designer or contractor to advise the project and communications contractor of the required quantity and location of these outlets. All STP outlets are to be clearly represented on the communications layout drawings and the outlet quantities included in the total outlet count per floor and per communications cabinet.

Communications outlets intended for control equipment such as Security access control, BMS, EMACS, monitoring and AV - must be terminated as standard wall outlets external and adjacent to the corresponding control device to ensure accessibility and maintain installation consistency.

6.9.7. CCTV Security Cameras

Unless otherwise advised by UNSW Security, all CCTV cameras will be connected via communications infrastructure to the Floor Distributor communications cabinet serving that respective location. Cameras will be patched to Power over Ethernet (PoE) switches, power injectors for cameras are not to be installed in communications cabinets. Separate provision is to be made for DVR equipment (if required) and other Security equipment as they are not to be housed within or placed on top of communications cabinets.

Please note: All equipment connected to the UNSW data network must comply with the UNSW Data Network Connection Policy - Network Devices. Refer to the following webpage for further information:

<https://www.it.unsw.edu.au/staff/policies/index.html#OtherIT-relatedPolicies>

6.9.8. IBC/DAS Mobile Phone Coverage

- In-building mobile coverage infrastructure (IBC/DAS) must be installed during major construction works for new or refurbished buildings if preliminary coverage surveys indicate a requirement.
- The complete design must be approved in writing by a major mobile carrier nominated by ITCS and is subject to final ITCS approval prior to installation.
- Adequate space must be allocated for cable termination, service provider equipment, and the DAS riser within the building.
- Projects may install only the DAS component during initial construction and reassess coverage upon completion. If coverage meets the acceptable threshold of 3 bars at -85dBm, the IBC component may not be required.
- If IBC is deemed necessary post-construction, it will be treated as a project cost and require budget allocation.
- Cable reticulation routes, supporting infrastructure, and space for active equipment must be considered and documented during the building design phase.

6.9.9. Fire Lines / FIP (Fire Indicator Panel)

Fire Indicator Panels within buildings are to be dual connected back to the university monitoring system.

Connection 1 - install structured copper cabling from the Floor Distributor cabinet serving that area and terminate as a standard communications outlet near the FIP.

Connection 2 - install structured cabling from the nearest voice connection frame for the floor or building to the FIP. This is usually the IDF or MDF. See the Fire Standards for cable type and installation requirements.

Please note: all FIPs at Kensington Campus are jumpered from the IDF or MDF in the remote building to the campus head end FIP located on upper campus by ITCS voice technicians.

Patch leads used for FIP connections must be red in colour, clearly distinguishing fire system connections from standard data services.

Cabling must comply with the requirements set out in the relevant Fire Standards (AS 1670, AS/CA S009:2020) and UNSW specifications.

The UNSW fire contractor is to be engaged by UNSW Facilities and will coordinate with the ITCS voice technician.

6.9.10. Optical Isolation for HV Substations

Definition:

An optical isolator is a device that uses a short optical transmission path to transfer a signal between elements of a circuit while keeping them electrically isolated.

High Voltage (HV) is classified as voltage exceeding 1000V for Alternating Current (AC) and at least 1500V for Direct Current (DC).

When a new substation is constructed at any UNSW campus, UNSW EM may request the installation of Optical Isolation.

Three acceptable methods for the installation of Optical Isolation are as follows:

1. Back-to-Back installation (HV room – Public space / corridor)
2. Back-to-Back installation (HV room – LV room)
3. Within the HV switch room installation with a 2-metre separation between the two enclosures.

The preferred installation type is Method 1.

The installation method details:

- For Method 1, the enclosures will be on either side of acceptable walls for this type of installation. A small penetration for optical fibre leads will link the two enclosures. The primary side of the enclosure will typically be located in the public or corridor space, while the secondary enclosure is within the HV substation. (Refer to Example 1 below).
- For Method 2, the primary side of the enclosure will be located in the LV side of the substation. The secondary enclosure will be mounted in parallel back-to-back or within 2m of the LV side. A link between the two enclosures will need to be established via a penetration or a secured conduit. (Refer to Example 1 below).
- For Method 3, the enclosures will be installed no less than 2000mm apart in the HV side of the substation. Prior to the use of this method, UNSW EM will provide feedback on acceptable mounting locations. (Refer to Example 2 below).
- The boxes will be earthed in according to AS/NZS 3000 - Electrical Wiring rules.
- A 10A double GPO is to be installed within both box locations.
- A minimum of 2 x Fibre Optic patch leads will link both Optical Isolator units. A label will be included to indicate each of the fibre leads. (Patch leads shall be installed in a conduit where exposed).

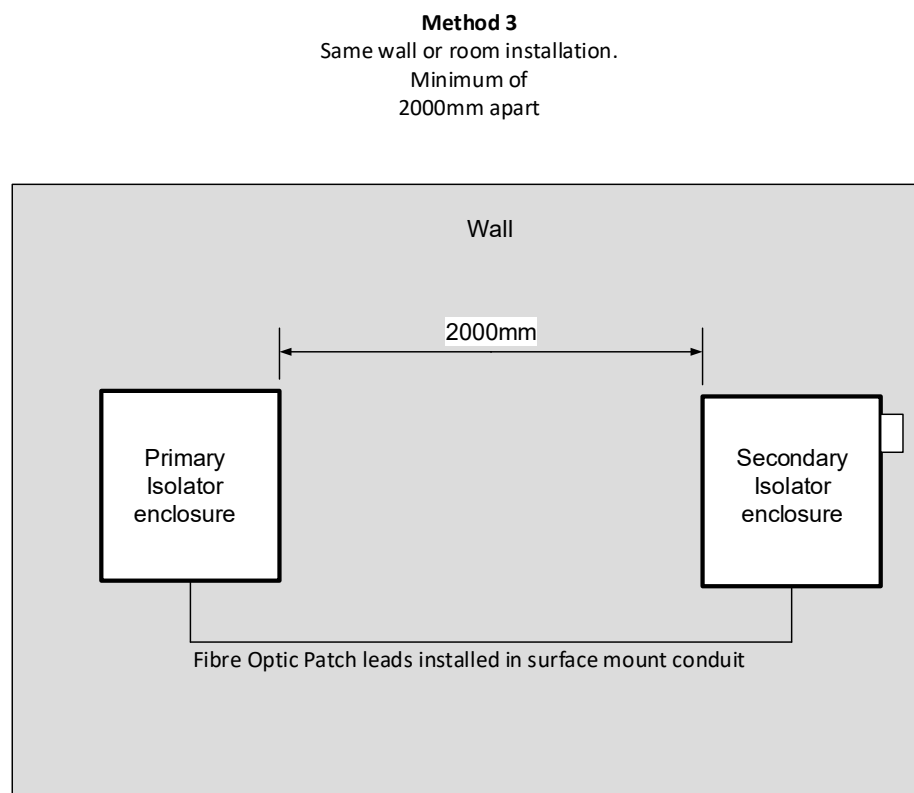
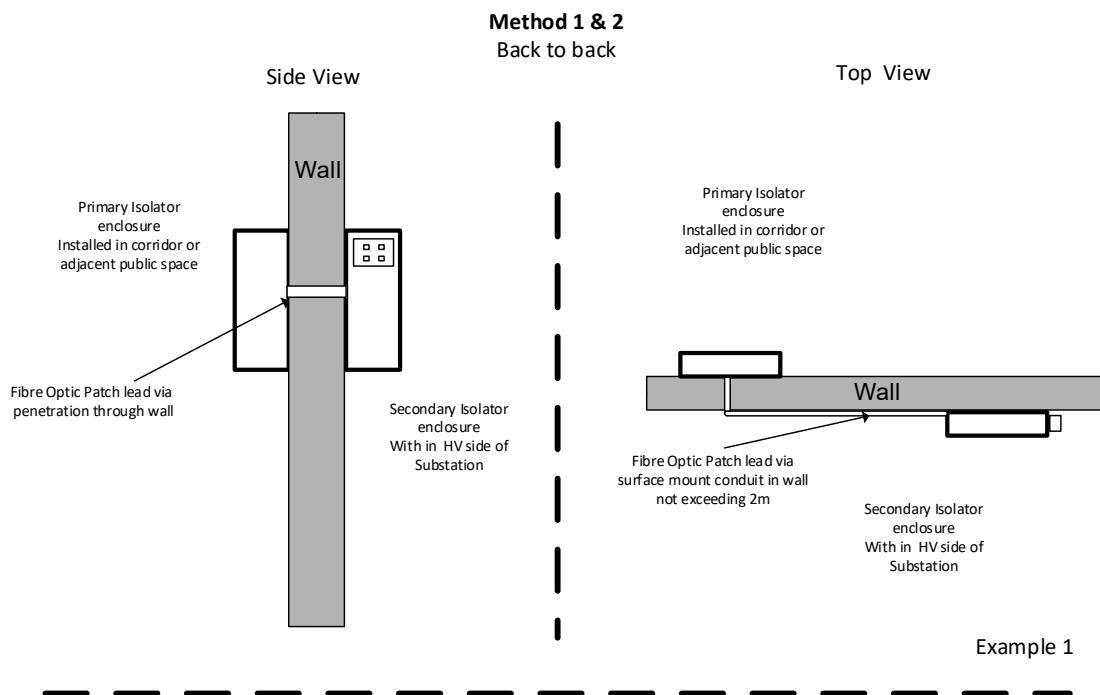
- 4 x 10/100 Base –TX to 100 Base – FX Bridge Media Converters shall be included.
- A minimum Quad data outlet emanating from the appropriate communications room floor distributor cabinet for that area is to be installed to the primary box location.

The secondary box will incorporate a minimum 2 x Quad data outlets. One outlet will be installed within the box and a second outlet on the outside of the box. The two outlets will be linked together via copper cabling. (*Refer to example 3 below*).

Important Note:

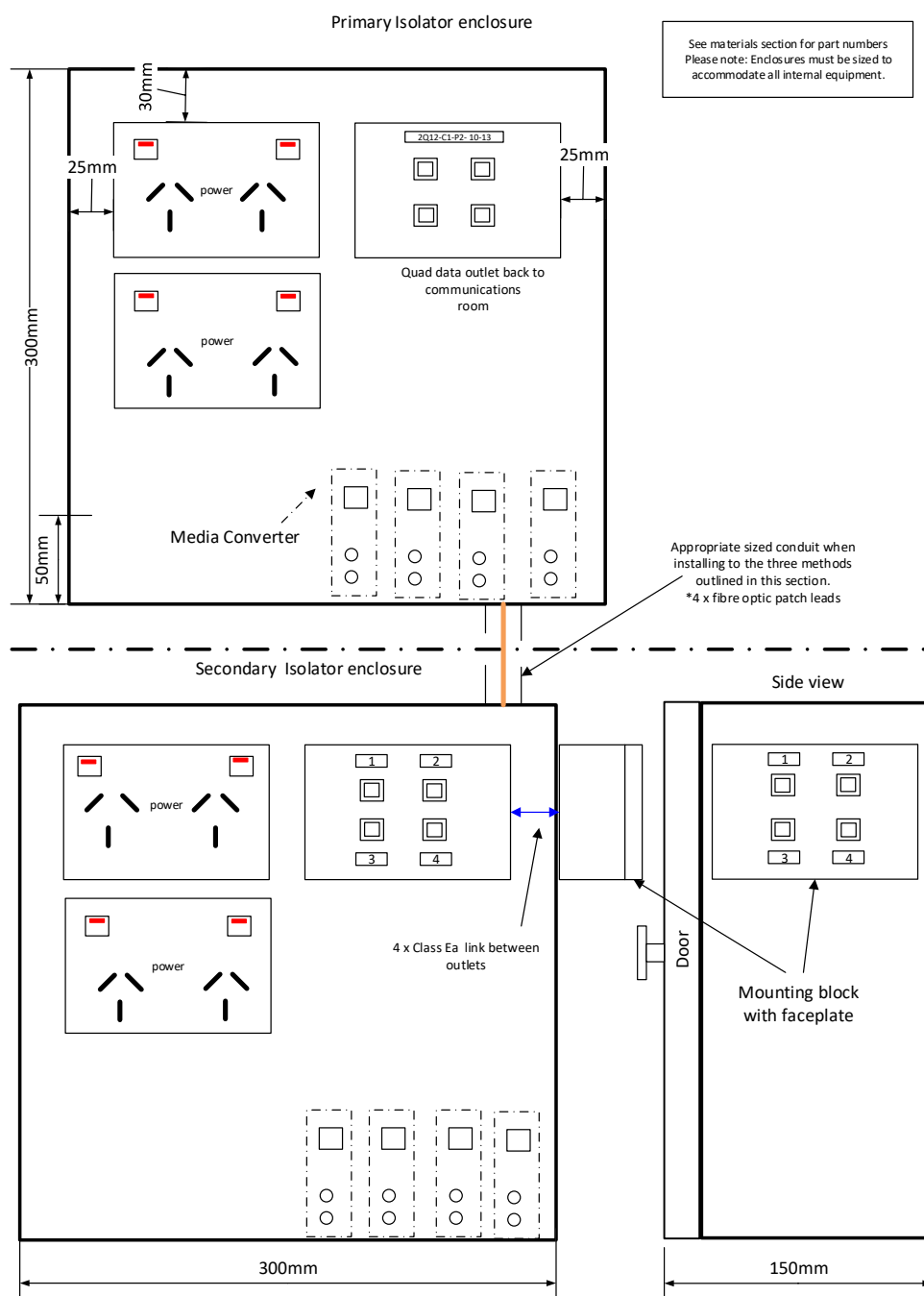
- **The standards outlined for Optical Isolation installation is a general guide only. Exact details, including the quantity of communications outlets and power outlets, must be confirmed by UNSW EM prior to the procurement of materials.**

The diagrams below provide examples of typical installation methods:



Facilities Management will provide feedback on acceptable mounting locations in HV substation.

Example 2



Example 3

Refer to Section 6 for specific materials required for optical Isolator installations. UNSW EM will confirm the outlet & power quantities for each project.

6.11.11 Fibre to the field

Where field devices require optical services, run structured fibre cabling from the nearest FDR/BDR to field enclosures and terminate as LC duplex, OS2 single-mode outlets. Use quality ecosystem components (e.g., Clipsal/Schneider,, Panduit) with compliant enclosures and adapters. Workmanship and components shall conform to ANSI/TIA-568.3-E and AS/CA S009:2020.

Pathways & Protection

- Fibre must be installed in dedicated pathways and conduits that protect against mechanical damage,

moisture, and dust ingress.

- Outdoor or external runs shall be enclosed in UV-rated conduit and terminated within IP-rated enclosures.
- Separation from electrical power cabling must be maintained in accordance with AS/CA S009:2020.

Bend Radius & Handling

- Minimum as per vendor specifications.
- No tight bends, crushing, or cable kinks are permitted.

Termination

- All fibre strands shall be terminated into compliant enclosures with SM LC duplex adapters and dust caps.
- Excess fibre shall be neatly coiled and secured within the enclosure splice tray or patch panel to prevent strain.

Labelling

- Each fibre core and termination panel shall be clearly labelled at both ends in accordance with the ITCS labelling schema (refer Section 6.12).

Enclosures & Components

- Use quality vendor ecosystem components such as Clipsal/Schneider, Corning, or Panduit.
- Enclosures shall be lockable, dustproof, and mechanically secured to building structure or approved mounting surfaces.

Testing

- All installed links must be tested with a calibrated OTDR and power meter/light source.
- Testing must verify insertion loss, return loss, and continuity for each fibre strand against the vendor's warranty standards.
- Test results must be submitted to ITCS as part of project completion documentation.

Environmental & Safety

- All penetrations must be sealed with fire-rated materials in compliance with building code.

General Requirements

- Contractors must not substitute fibre types, connectors, or termination methods without prior ITCS approval.
- Fibre outlets shall be installed at a practical working height within the enclosure (minimum 300 mm above finished floor level if wall mounted).
- Workmanship must present a neat, accessible, and maintainable installation.

6.9.11. Access Control

All telecommunications rooms shall have mandatory electronic access control system installed for swipe access with event logging. Designers and contractors shall engage UNSW Security during design to add each room to the relevant security control group, cabling, and define and add access roles to users.

6.10. Labelling

The administration system is to ensure that the cabling system is adequately and uniquely identified.

All wall outlets, patch and voice panels, cabinets, voice frames and CETs shall be labelled in accordance with the guidelines described in this document. The contractor is to use the ITCS reverse labelling

scheme. The labelling system shall clearly identify all components of the system: Racks, Cables, Panels and Work Area outlets.

All cable runs shall be labelled at both ends in accordance with the numbering scheme on the drawings provided for the Overall Project.

The labelling system shall designate the cables origin, destination and a unique identifier for the cable within the system. Racks and patch panels shall be labelled to identify the location within the cabling system infrastructure. All labelling information shall be recorded on the as-built drawings and all test documents are to reflect the appropriate labelling scheme.

Please note: Prior to the commencement of labelling confirm that the room numbers on issued drawings are the final, official UNSW room numbers. Architects or preliminary room numbers on preliminary or final as-built drawings, test results, patch panels and outlets will not be accepted.

Labels must be:

- Machine printed, Traffolyte labelling.
- Handwritten labels are not permitted.
- Installed in a manner that ensures long-term legibility and adhesion.

6.10.1. Internal Cable & Outlet Label Schema

Labels for the cabling should be placed within 150-300mm of each cable end/termination in the location that will be most visible after completion of work. The cabinet end termination shall have a machine generated “wrap around” or “self-laminating” style label affixed to the cable. The work area location label can be achieved utilizing a permanent style marker.

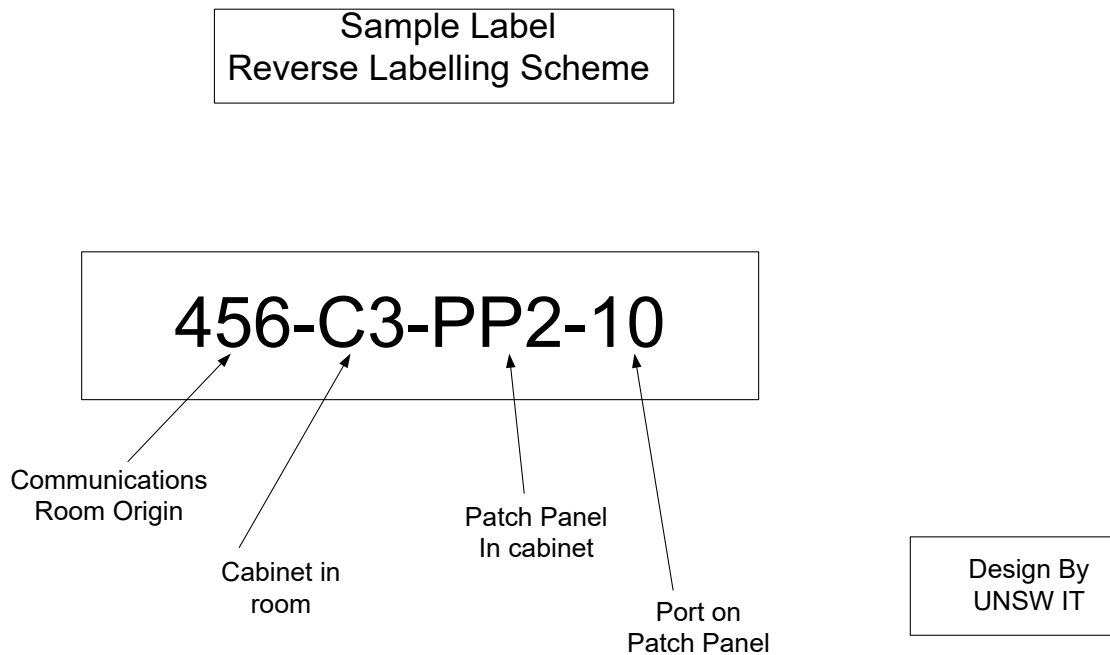


The field end RJ45 ports should be clearly labelled with far end termination details:

Communications Room Number -	The room that contains the terminating patch panel.
Cabinet Number -	The cabinet that contains the terminating patch panel.
Patch Panel Number -	The patch panel number within the cabinet.

Patch Panel Port -

The RJ45 port on the patch panel.

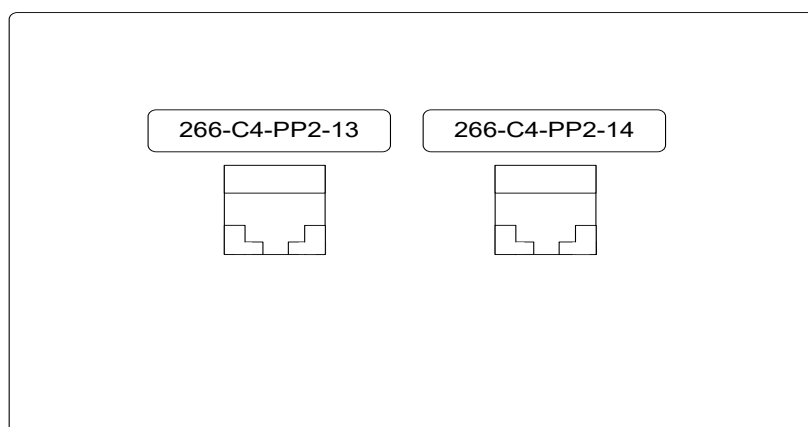
**6.10.2. Face Plate Label**

Outlet labels shall be engraved on self-adhesive black on white Traffolyte. Unless otherwise stated, the size of label characters shall be a minimum 6mm x 6mm.

NOTE: Sample labels are to be provided during the “Submittals” process for approval prior to installation. Any alternative method is to be approved by ITCS.

The outlet faceplate label below indicates the approved method for labelling STP cables terminating at a UNSW network outlet.

Outlet Faceplate Sample



Design By
UNSW IT

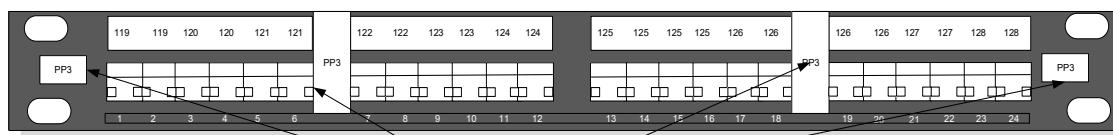
6.10.3. Cabinet Label

Individual cabinets within a single room should be labelled “C1” through to “Cn” where “n” is the number of cabinets in the room. The cabinet should be clearly marked on the front-top panel (on the cabinet housing above the cabinet front door). This label is to be Traffolyte 50mm x 50mm in size and be legible from 2m.

6.10.4. Patch Panel Number Label

Individual patch panels should be labelled sequentially within a cabinet starting at “P1” through to “Pn” where “n” is the number of horizontal patch panels in the cabinet. “P1” is the first (highest) horizontal STP patch panel. The label should be placed at each end and the 1st and 3rd space of every panel. See Diagram 3a.

Cat 6A Patch Panel number label



Patch Panel Number label
locations

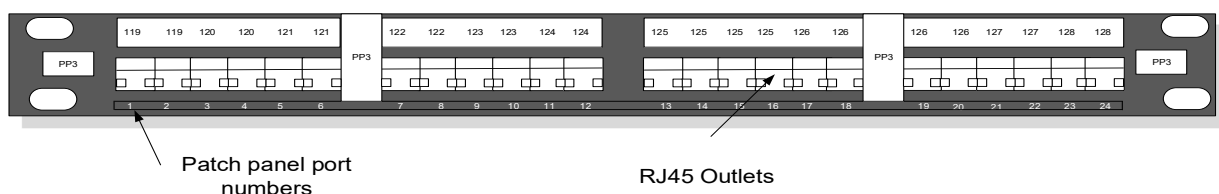
UNSW ITCS

Diagram 3a

6.10.5. Patch Panel Port Number Label (1-24)

Individual RJ45 ports within a single patch panel should be labelled sequentially 1 to 24 (assuming a 24 port patch panel). This labelling is normally supplied on the patch panel. See Diagram 3b below.

Cat 6A Patch Panel port number label



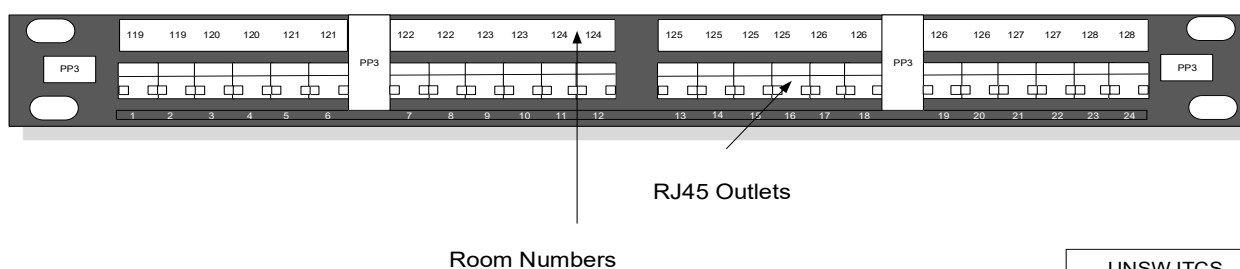
UNSW ITCS

Diagram 3b

6.10.6. Patch Panel Room Number Labels

Patch panel port labels - individual RJ45 ports are to be labelled with the room number of their far end termination. This label should be machine generated and affixed at completion of work. See Diagram 3c.

Cat 6A Patch Panel room number label



UNSW ITCS

Diagram 3c

6.10.7. Patch Panel Specific Services Labels

Patch panel ports for specific services will be labelled to identify the service type and the location of the port. See examples of the labels below.

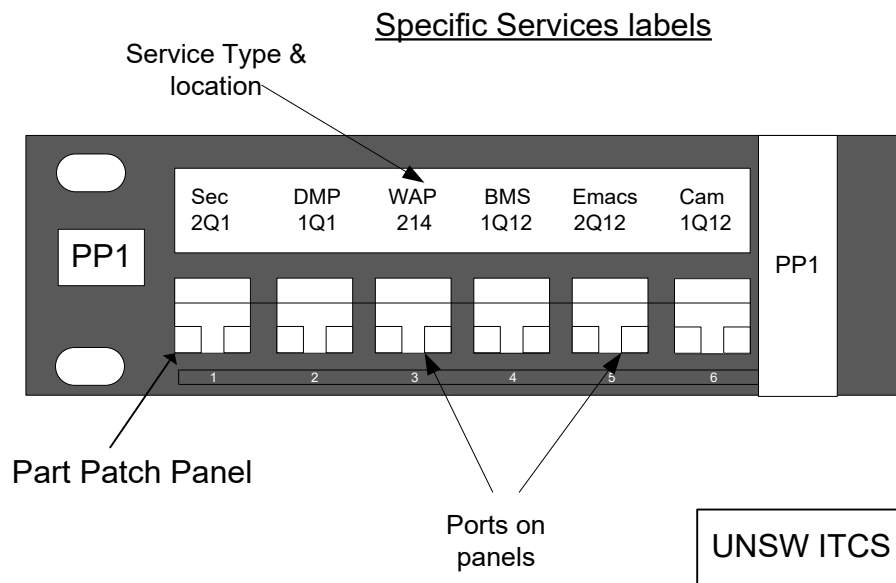


Diagram 3d

6.10.8. Voice Panel Labels

Voice panels are to be labelled as per example Diagram 3e below. 25 port voice panel will be similarly labelled ports 1-25.

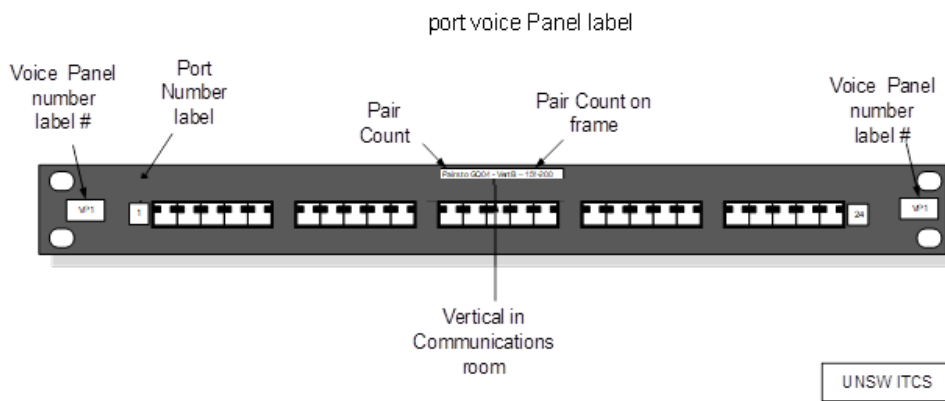


Diagram 3e

6.10.9. STP Tie Panel Label

Copper Tie panels will reflect a similar label format to the Patch Panel. Tie panels are identified by the infrastructure type, i.e. Fibre or Copper. Copper tie panels within a single cabinet will be identified with "TP1". The "T" referring to the Copper Tie. Generally, there is only one copper tie panel in each Floor cabinet. The Building Distributor cabinet/s will house STP ties to all Floor cabinets. Diagram 4 illustrates the labelling scheme.

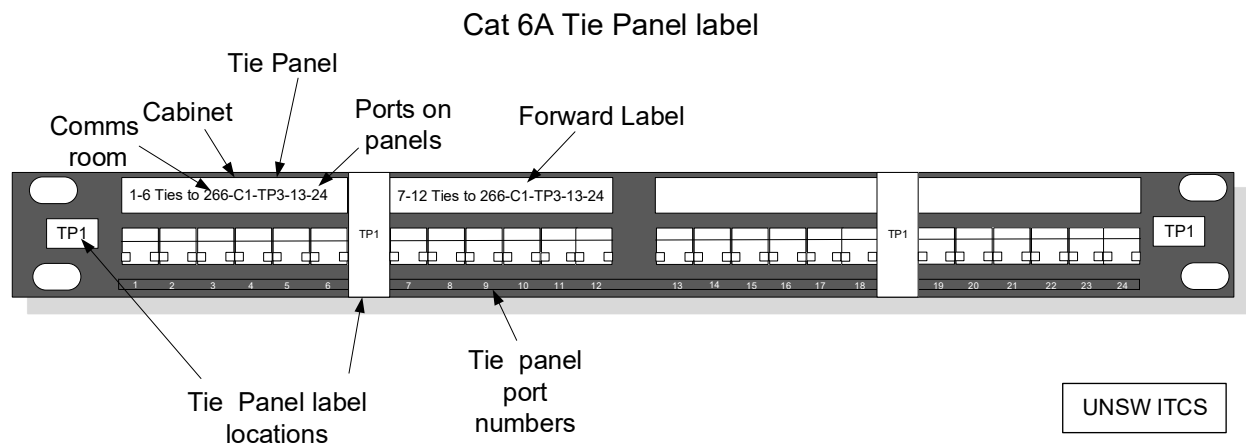


Diagram 4

6.10.10. Internal Backbone Fibre Tie Panel Label

Fibre Tie panels have a similar label format to the Patch Panel and the Copper Tie Panel. Fibre optic tie panels within a single cabinet will be identified as “FP1”. The “F” referring to Fibre Tie. The Building Distributor cabinet will house multiple fibre panels. Floor Distributor cabinets will generally house one or two fibre panels. Diagram 5a illustrates the labelling scheme for internal tie cables in the Building Distributor cabinet and Diagram 5b illustrates labelling at the Floor Distributor cabinet end.

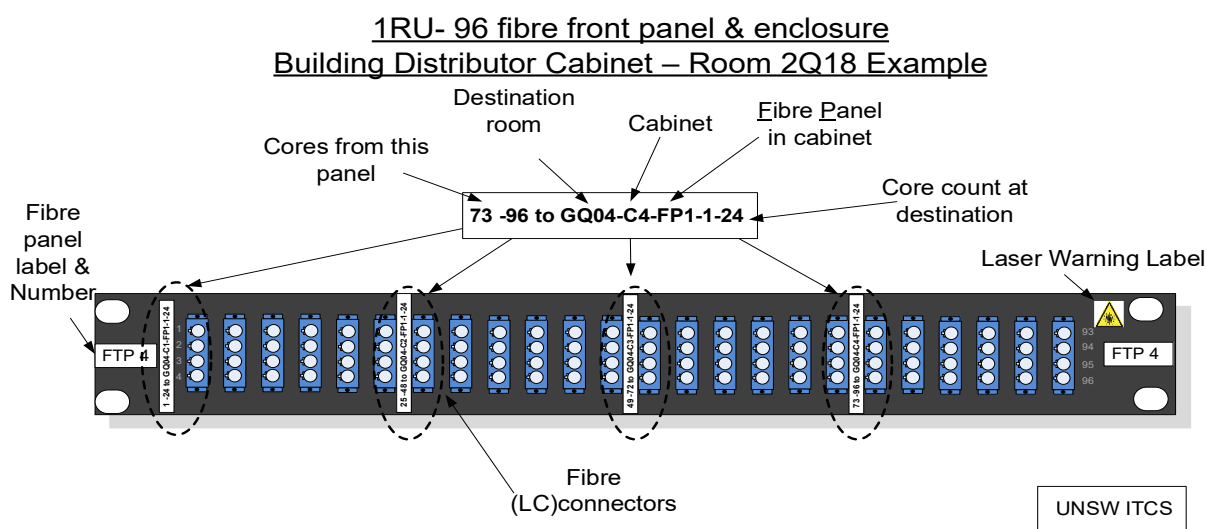


Diagram 5a (Refer to Section 5 for specific part numbers)

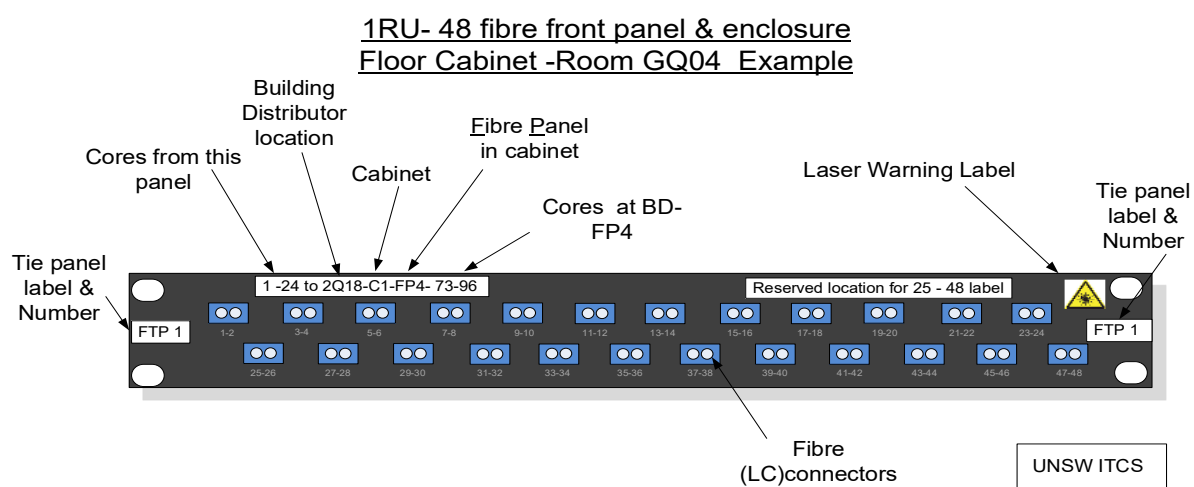


Diagram 5b (Refer to Section 5 for specific part numbers)

Note: The High Bandwidth fibre panel in Cabinet 1, BDR must be high density 96c front panel. 48 core illustrated in diagram 5b is for FDR rooms only.

6.10.11. Campus Backbone Fibre Tie Panel Label

The external Campus Backbone fibre tie panel has a similar label format to the internal Backbone Fibre Panels. Fibre optic tie panels within a single rack will be identified as “FP1” through to the quantity of fibre panels (internal and external) that are installed each individual Building Distributor rack.

Generally, there is one external Campus Backbone fibre tie panel in the Building Distributor cabinet for a building. Diagram 5c illustrates the labelling scheme.

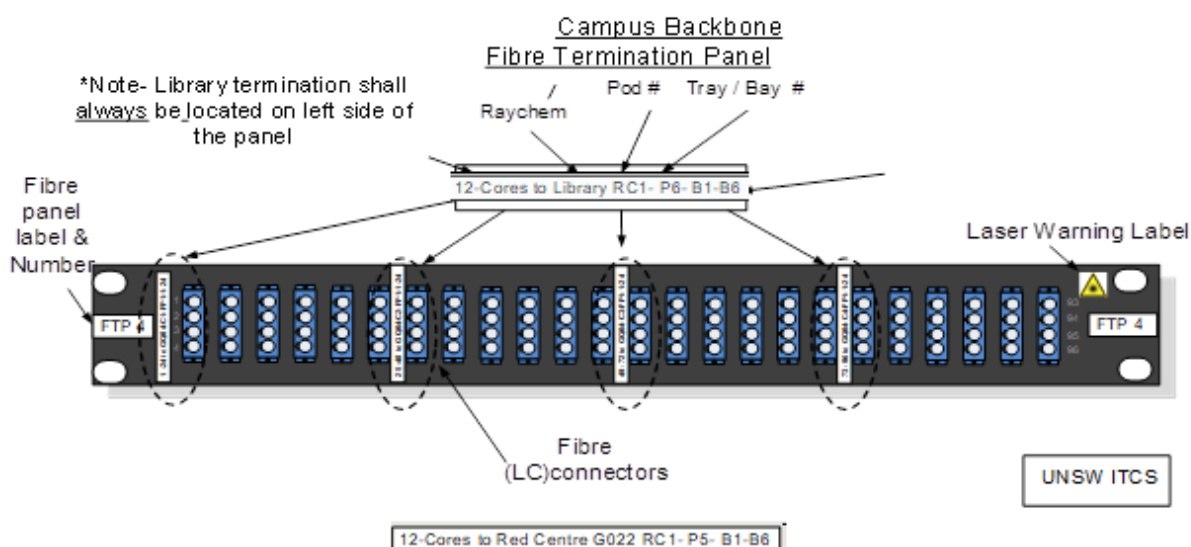


Diagram 5c

6.10.12. Laser Signage

Fibre Optic patch fields shall include laser warning signage. There are two labels required:

1. Laser Warning Label.
2. Laser Explanatory Label.

The Laser Warning Label must be affixed to the terminating fibre panel within each communications cabinet. Please refer to Diagrams 5b and 5c for guidance on the recommended location of the label.

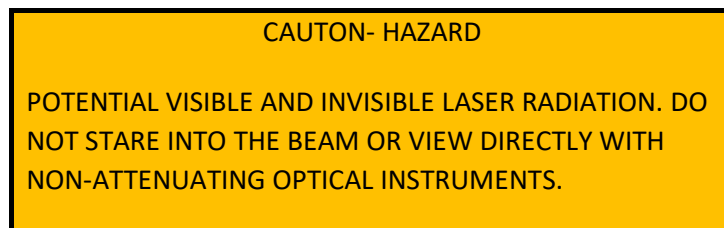
The Laser Explanation Label is to be fixed to the exterior of the cabinet door. The acceptable locations for affixing this label include :

1. On the cabinet door adjacent the key lock housing, or
2. At the very top section of the cabinet door.

This label shall be made from Traffolyte material and remain legible from 2m. The following is an example of the two labels:



Laser Warning Label



Laser Explanatory Label

6.10.13. Voice Frame Labels and Records

Frame Label

All voice frames shall be labelled clearly at the front top of each frame. This label shall be large enough to be seen from 2m and be affixed in appropriate way. Each frame shall be labelled with a unique identifier. The furthest left frame shall be labelled "A" proceeding to the right it will continue "B" etc. Numbering shall follow a top-to-bottom numerical sequence.

6.10.14. Voice IDC Label Holder

A label holder is required at a minimum every 100 pairs on a frame. Help Points and Lift Phones will have their own individual label holder where the cable is terminated at the top of each frame. Refer to Diagram 6 below

IDC Label Module/Holder for Voice frames

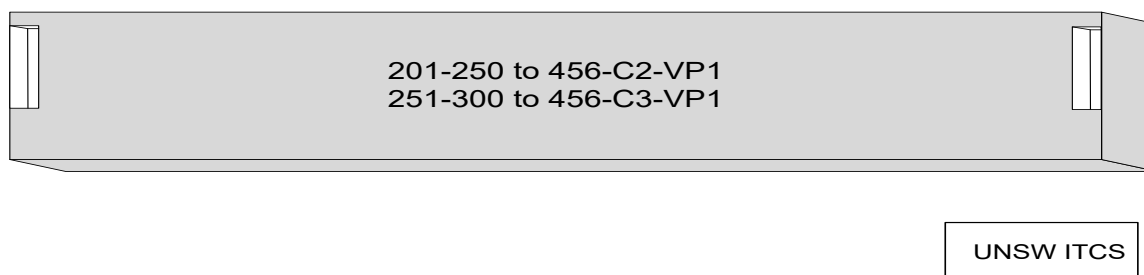


Diagram 6

Record books

A3 Perspex covered record sheet holder with the necessary number of sheet inserts is required for the MDF and a standard record 1000 pair book for the IDF's is required in each Communications Room.

Cable tie information is to be entered in the Record Book prior to construction handover.

6.10.15. External Backbone Cable Label

All internal and external Fibre and Telephone backbone cables shall have a label and/or Identification plate attached to cables at the closest visible point prior to the cable exiting the building, in every pit along the cable route, and at the closest visible point where the cable entry to the building. Usually, this identification plate or label is made of water-resistant material and securely attached to the cable physically via a cable tie or similar.

The following information shall be clearly printed on the label. Refer to Diagrams 7 and 8 below as examples.

- From "Building Name" - Room "# " – To "Building Name" - Room "#"
- Core count
- Type (Single Mode or Multi Mode and Make)
- Installed by "your Company Name"

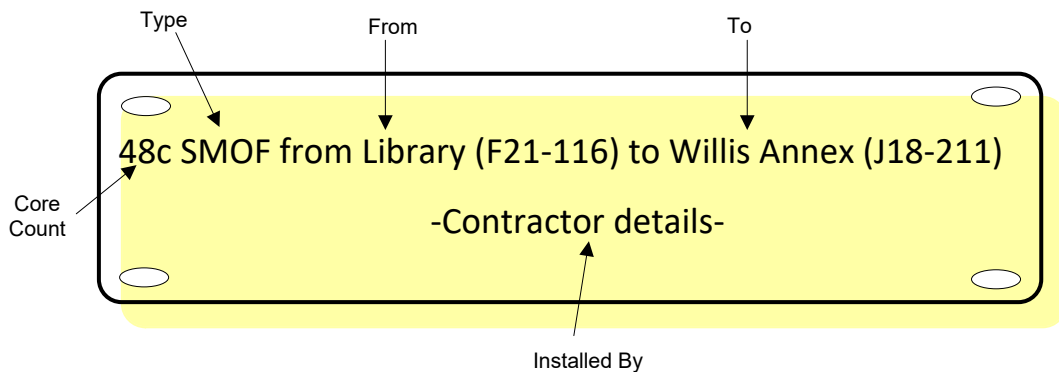
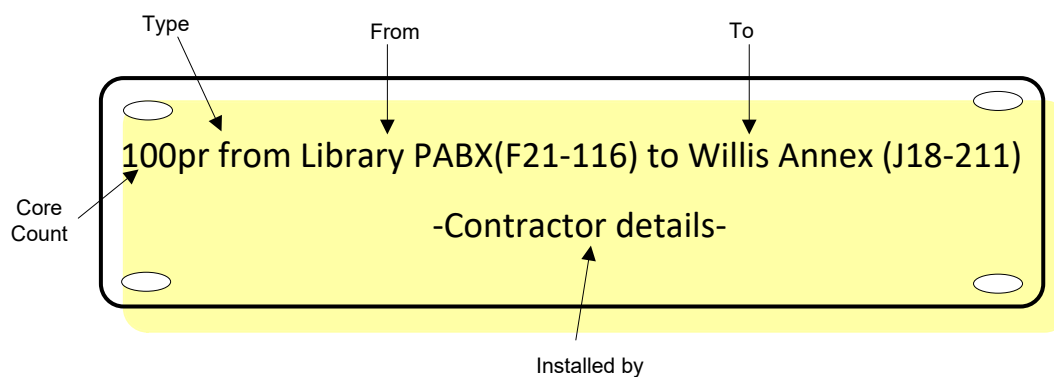


Diagram 7

**Diagram 8**

6.11. Testing Compliance and Certification

Testing, Compliance and Certification form a significant part of the overall installation and warranty program at UNSW. Working together with the vendor, ITCS's goal is to achieve a high standard of installation and compliance.

ISO/IEC 11801 define all the performance parameters and test limits to be measured for Installation conformance.

Testing and Certification of all installed infrastructure shall be carried out by an approved contractor qualified under the Vendors 25-year Installers Warranty Program. Proof of certification and qualifications of personnel may be requested at any time. ITCS is to be invited to witness sample tests and reserves the right to witness all testing.

Test results are to be issued to ITCS prior to the installation and activation of network equipment.

The test equipment for copper cabling must comply with AS/NZS ISO IEC 61935.1, using a Level IIIE test device or better. The test device shall carry a calibration certificate not exceeding 12 months. This calibration certificate shall form part of the test documentation.

For Optical Fibre testing, adhere to AS/NZS IEC 14763.3. The cable will be tested to wave lengths 1310nm & 1550nm.

Compliance testing as a minimum shall be achieved on all new communications infrastructure.

Compliance testing mandates that field testing is undertaken on all known and unknown components of an installation.

All cabling links shall be 100% tested to ISO / IEC or AS/NZS standards limit to verify both copper and fibre links meet the structured Cabling Systems performance requirements. The contractor must also comply with the vendors 25-year Installation and Warranty program.

Installed cabling shall NOT be tested to the TIA Standard.

*Passes are not accepted by ITCS.

6.11.1. Copper Testers Accepted by UNSW

The following copper testers are acceptable for use to complete installation testing for UNSW. The contractor must seek written acceptance by ITCS prior to use an alternative tester.

1. Fluke *DSX CableAnalyzer* series (DSX-5000, DSX-8000, DSX-602)

The contractor is responsible for inputting the correct NVP (Nominal Velocity of Propagation) value for all Class Ea installation testing. All test result documentation shall be provided in both “PDF” and “.flw” formats. Diagram 9 provides an example of an individual test result in PDF format.

Testing must comply with AS/NZS ISO/IEC 14763-3 and TIA-1152-A (field testing standards).

All permanent links must be tested to ISO/IEC 11801 Class Ea / TIA Cat6A performance as a minimum.

Testing parameters must include:

- Wiremap
- Length
- Propagation delay & delay skew
- Insertion loss
- NEXT & PSNEXT
- ACR-F/PSACR-F (formerly ELFEXT/PowerSum ELFEXT)
- Return loss

All test results must show PASS in accordance with the selected standard and cable category.

Testers must be calibrated within the manufacturer’s recommended cycle (typically 12 months) and calibration certificates must be provided to ITCS upon request.

Any failed or marginal test results must be investigated and rectified by the contractor at no cost to UNSW. A “star” pass is considered a failed result and shall be rectified.

ITCS may conduct independent spot testing, and discrepancies must be resolved to ITCS’ satisfaction before project acceptance.

ITCS reserves the right to carry out independent cable tests subsequent to the submission of test reports. Any anomalies identified between test results must be explained and/or rectified to the satisfaction of ITCS.

**Cable ID: GQ09-C04-P07-22**

Date / Time: 05/02/2015 08:20:19 AM

Headroom 3.9 dB (NEXT 45-78)

Test Limit: ISO11801 PL2 Class Ea

Cable Type: Tyco Cat 6A F/UTP CMR

Calibration Date: 17/03/2014

Operator: MONZ

Software Version: 2.7400

Limits Version: 1.9300

NVP: 72.0%

Test Summary: PASS

Model: DTX-1800

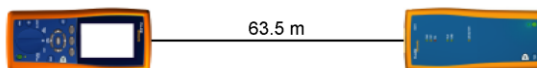
Main S/N: 9758179

Remote S/N: 9758180

Main Adapter: DTX-PLA002

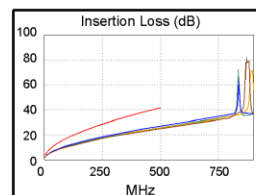
Remote Adapter: DTX-PLA002

Length (m)	[Pair 36]	63.5
Prop. Delay (ns), Limit 496	[Pair 12]	314
Delay Skew (ns), Limit 43	[Pair 12]	20
Resistance (ohms), Limit 20.6	[Pair 12]	8.9
Insertion Loss Margin (dB)	[Pair 45]	14.5
Frequency (MHz)	[Pair 45]	500.0
Limit (dB)	[Pair 45]	41.6



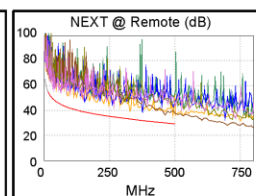
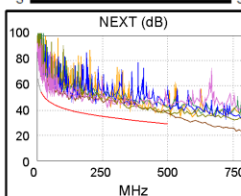
Wire Map (T568A)

PASS

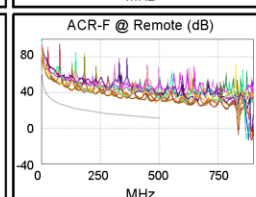
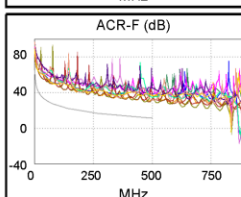


Worst Case Margin Worst Case Value

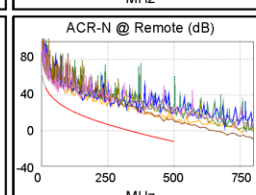
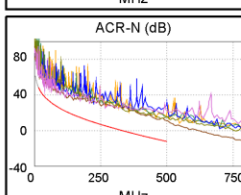
PASS	MAIN	SR	MAIN	SR
Worst Pair	45-78	12-36	36-45	12-36
NEXT (dB)	3.9	6.3	7.5	6.3
Freq. (MHz)	38.5	493.0	499.0	493.0
Limit (dB)	48.5	29.4	29.3	29.4
Worst Pair	45	36	36	36
PS NEXT (dB)	6.0	7.3	6.5	7.8
Freq. (MHz)	38.5	462.0	473.0	493.0
Limit (dB)	46.1	27.2	26.9	26.5



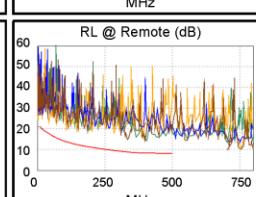
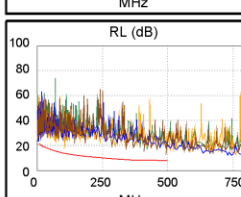
PASS	MAIN	SR	MAIN	SR
Worst Pair	36-12	12-36	36-12	12-36
ACR-F (dB)	17.1	17.1	17.1	17.1
Freq. (MHz)	487.0	487.0	487.0	487.0
Limit (dB)	11.5	11.5	11.5	11.5
Worst Pair	12	36	12	36
PS ACR-F (dB)	19.3	18.2	19.3	18.2
Freq. (MHz)	487.0	483.0	487.0	484.0
Limit (dB)	8.5	8.6	8.5	8.5



PASS	MAIN	SR	MAIN	SR
Worst Pair	45-78	45-78	36-45	12-36
ACR-N (dB)	8.0	12.8	22.1	22.3
Freq. (MHz)	38.5	38.3	499.0	493.0
Limit (dB)	37.8	37.8	-12.3	-11.9
Worst Pair	45	45	45	36
PS ACR-N (dB)	9.8	14.6	23.5	23.8
Freq. (MHz)	38.5	38.3	499.0	493.0
Limit (dB)	35.3	35.4	-15.2	-14.8



PASS	MAIN	SR	MAIN	SR
Worst Pair	45	36	78	12
RL (dB)	6.0	5.2	8.2	6.2
Freq. (MHz)	7.0	41.8	495.0	402.0
Limit (dB)	21.0	17.8	8.0	8.0



Compliant Network Standards:

10BASE-T 100BASE-TX

1000BASE-T 10GBASE-T

ATM-51 ATM-155

TR-4 TR-16 Active

100BASE-T4

ATM-25

100VG-AnyLan

TR-16 Passive

LinkWare™ PC Version 9.3

Project: UNSW
Building: J17
Telecom Room: GQ09
Patch: P07

UNSW-All-Consolidated-LBL.flw
Floor: Level 0
Rack: C04

FLUKE
networks.

Diagram 9

6.11.2. Optical Fibre Testing

Optical fibre testing has no specific pass-mark set by the Standards. Instead, the Link Loss Budget is what determines the acceptable testing parameters of a fibre optic link. The Link Loss Budget is calculated by adding the allowable losses of all components used in the optical link path.

ISO/IEC 11801 specifies the testing requirements for Optic Fibre cabling. ISO/IEC 14763-3 specifies how to complete the testing. A 1-Test cord is preferred, although a 3-Test Cord is also acceptable. For Optical Fibre testing, adhere to AS/NZS IEC 14763.3. The cable will be tested using 1310nm and 1550nm Wavelengths.

All fibre test results shall be certified in accordance with the vendor's certification guidelines.

6.11.3. Voice Pair Testing

All copper voice cabling shall be tested to ensure that continuity, pair positioning and polarity are identical at each end of the termination. This includes all campus backbone and building backbone tie cabling. ITCS reserves the right to witness testing.

6.12. Inspections, Defects and Completion

6.12.1. Site Inspection

ITCS will conduct regular inspections as the construction and cabling work progresses and will expect to view communications rooms and risers prior to fit-out and cabling installation, and before walls are sheeted and ceilings installed. As a minimum requirement, ITCS shall be invited to conduct site inspections at installation completion stages: 30%, 60%, 90%, and 100%. In all instances, the contractor shall also arrange for the vendor or certifying authority to inspect the works at regular intervals and report on all portions of the installation.

The final inspection for the STP Cabling System will be conducted once all as-built drawings, STP cabling system test results and certification records, communications room final fit-out and cleaning, external works and any other works covered by the Communications Specification are complete and defects have been rectified.

6.12.2. Defects

ITCS will submit Inspection Reports including defects to the Project following site inspections. The Contractor must rectify all reported defects within seven (7) days of notification, unless otherwise specified in the contract.”. The Project/Contractor must maintain and update a defects register of all reported communications services defects and is to provide a complete copy of the defects register with updated information and shared with ITCS as the defects are rectified. Photographic evidence of defect rectification before ITCS sign-off.

Life-safety related defects (fire, power segregation, earthing, or security risks) must be rectified immediately, not within 7 days.

Please note: Dust ingress into communications rooms after UNSW network switches have been installed prior to building handover poses a significant risk to the operation of the equipment and may result in irreparable equipment failure. The project is responsible for ensuring a dust free, cool environment in communications rooms and communications cabinets from the time of the first network switch installation until the building is handed over. It is mandatory that an extra final clean/vacuum is carried out by the builder just prior to handover.

6.12.3. Practical Completion/Final Passive Infrastructure Completion

After ITCS is satisfied with all installations and cabling test results, the STP Cabling System must be formally handed over to ITCS. All major works and critical outstanding items must be completed prior to handover to ITCS.

The contractor shall be responsible for carrying out all requested tests and presenting all works and equipment supplied and installed for the System for inspection during works in progress and after completion.

All works for fibre and copper cabling system shall be practically completed on or before the practical completion/handover dates specified within the Overall Project's main contract. The STP Cabling System shall be handed over to ITCS at this time for subsequent installation of network active equipment and commissioning and end user communications equipment such as phone handsets, computer equipment, printers etc.

Final completion may occur after Practical Completion/Handover and is considered to mean that all defects identified during the Defects Liability Period must be closed in the defects register and verified by ITCS.

Please refer to Section 3 Submittals for the documentation required upon completion of the works.

7. Appendix

7.1. Appendix A – Exception Register Form (Template)

Purpose. This form shall be completed by any contractor, consultant, or vendor seeking a deviation from the *Communications Design & Installation Standards*. It must be submitted at tender and updated throughout delivery. No works may proceed on non-compliant elements without formal written approval from UNSW.

Exception Register Form

Field	Description / Entry
Clause ID	Reference number of the clause from the Standards (e.g., 6.10.2).
Requirement Text	Full text of the requirement as written in the Standards.
Proposed Exception	The specific deviation requested (e.g., reduced fibre core count, alternative pathway method).
Reason	Justification for the exception (e.g., physical constraint, site condition, cost impact, safety consideration).
Impacted Rooms / Scope	Identify all rooms, buildings, or project areas where this exception will apply.
Standards Affected	List relevant industry or statutory standards potentially impacted (e.g., AS/CA S009, TIA-568.3-E).
Risks (H/M/L)	Categorise risks arising from the exception: Service Availability, Safety/Compliance, Security, Maintainability, Cost/Program. Mark each as High (H), Medium (M), or Low (L).
Mitigations	Detail controls, alternatives, or compensating measures that will address the identified risks.
Drawing References	Provide associated drawing numbers, sketches, or markups that show the exception.
Approvers	Required sign-offs: UNSW IT Technical and Management sign off
Expiry / Conditions	Specify whether the exception is permanent, temporary (with expiry date), or conditional (e.g., subject to further works).

Instructions

1. Each exception must be submitted on a separate form.
2. Exceptions must be numbered sequentially and logged in a project Exception Register.
3. UNSW reserves the right to reject exceptions that create unacceptable risk to safety, compliance, or critical services.
4. Approved exceptions must be carried on-site and included in the As-Built documentation set.

7.2. UNSW Approved Equipment List

7.2.1. Cabinets and Enclosures

The part number **CRSRC45808UNSW** is a generic code for UNSW when ordering a fully equipped CRS Rack Frame (45RU x 800 deep x 760 wide). The following individual part numbers are as follows:

CRS Part #	Description	Quantity per rack
RF458080	Frame 45RU x 800mm deep x 760mm wide	1
MDP45800BT	Fully perforated Metal door 45RU X 760Wide	1
MDB45800BT	Barn door 45RU x 760 wide-fully perforated	1 set
SP45800	Side Panel 45RU x 800 deep	2
LKPC-92268-LF	92268 Profile Cylinder	2
TP80880UNSW	Top panel 800mm deep x 760mm wide 2 x 300mm x 100mm cut outs	1
VCM70/110	Vertical Cable Manager 70mm wide x 110mm deep c/w hinged cover	2
CT45300NC	Cable tray 45RU x 300mm. No Cut out.	2
RMF760UNSW	Rack Mounted Fan Centre Mounted 760 wide cab 2 fans	1
VPB1200/15APM16AB	12-way vertical power rail with AS/NZS 3112-compliant 15A plug and integrated 16A circuit breaker for FDR cabinets	2
Enlogic EN6325/SRA6325-20AFP	BDR leaf cabinet and CDR cabinets only. BDR - Enlogic outlet Metered, Switched iPDU 220-240VAC, 56 series 56P320 20A captive plug, (20)C13, (4)C19 CDR - Enlogic outlet Metered, Switched iPDU 220-240VAC, 56 series 56P332 32A captive plug, (20)C13, (4)C19	2

Note: All rails are to be setback 155mm from the front edge of the frame.

- Side panels are usually only required at each end of a line of ganged cabinets.
- For alternative rack sizes (e.g. 24RU or 12RU), please contact ITCS to confirm specifications and obtain approval.

7.2.2. Internal Horizontal & Voice Materials

Material	Part #
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F/UTP cable	Cat 6A F/UTP Cable, 23AWG, OD 7.2mm, LSZH, Blue - 305mtr Reel NETCONNECT - PN#: 1859218-6
Patch Panel	24 port STP Patch Panel, 19" - 1RU (INCLUDES rear Cable Management) - DDM Flush mount. UNLOADED CommScope NETCONNECT – PN# 760237046
	CommScope Saddle & Velcro Strap Kit. Required for rear cable manager CommScope NETCONNECT – PN# 760229179
Flush mounted SL- Series Jack (For both field outlets and panels) Optional side entry Jack for skirting duct where bend radius could be compromised.	Cat 6A 500Mhz RJ45 AMPTWIST Shielded SL Series Jack - 180° Exit AMP-TWIST SLX, 6AS,GY – PN#2153449-4
	AMP-TWIST SL-Series Modular Jack, category 6A, shielded, 4 pair, for F/UTP cables, side exit, without dust cover CommScope NETCONNECT – PN# 1711343-2
2 Port Surface mounted Box	Surface Mount Module, 2-port, unloaded, White – suit SL Jacks SMB-2P-266 Surface Mount Box – PN#760248527
Cable organisers/managers (Ring Runs)	1 RU Deep Horizontal Ring Run (DRR) Molex – PN#: 25.B035-04
Voice Patch Panel	25/50 Port Voice Patch Panel, UTP, 1U - Pairs 3/6, 4/5 Molex PN# : PID-00145-04
Voice Frames	Profil Frame Krone and Netconnect are recommended. (66-way frames for CD's & BD's as a standard. FD's will be 55way as a minimum).
10 pair IDC Modules	Krone and Netconnect are recommended.
Telephone Cable	100Ω Multipair Indoor cable to the pair count required (Cat 3 min). See line diagrams for sizing locations.
A3- Perspex Record Sheet Holder	Krone PN#: KROWMDFRBH

Record Sheets	<i>Krone PN#: KROWDF</i>
Patch cables and fly leads	Patch leads (and occupant fly leads) will be provided by ITIP.

7.2.3. Materials & Part Numbers for Optical Isolators *

Description	Part #
Econo EC- 300mm x 300mm x 150mm- enclosure	B&R- EC3315
Econo EC Lock- Wing Knob Lockable Keyed 92268	B&R- NI030
Vent Kit – External-Zinc Coated 130 x 130mm	B&R-IPVK

* Please seek written confirmation from UNSW EM on the quantity of communications outlets required within each substation. The requirements may affect the enclosure size and detailed design.

7.2.4. Backbone Fibre, Voice & Support Infrastructure Materials

The following table describes the materials to be used for Backbone installations.

Materials	Part #	
Single Mode Optical fibre	External:	Internal:
	<u>Yellow</u> Sheath Loose Tube. Typically, 48core This cable will be a Commscope Netconnect or a Molex approved cable.	<u>Yellow</u> Sheath Tight Buffered indoor / outdoor LSZH riser cable <u>24 core:</u> Molex PN#: AFOIR024OS2 <u>12 core OR (6 core HSRN):</u> Molex PN#: c
	See line diagrams for sizing and locations.	
Fibre Enclosure	External:	Internal:
	Fibrenet: Enclosure: 3 RU Commscope Netconnect PN#: (1154033-3) RTC3G-0-96-FS Item to be installed at: Building Distributor cabinet.	Molex: MLX-1RU Multi-Function Fibre Enclosure Molex PN#: RFR-00311 Item to be installed at: Building Distributor & Floor Distributor cabinets.
Fibre Termination	External:	Internal:
	Fibrenet: 12- Port APC plate Commscope Netconnect PN#: (2-1154033-3) RTCG Adapt plate SCA12Z Item to be installed at: Building Distributor cabinet	Molex: 96 Fibre front panel to fit multi- function enclosure (loaded) Molex PN# SP135082 (Keystone facing left) Item to be installed at: Building Distributor cabinet
		Molex: 96 Fibre front panel to fit multi- function enclosure (loaded) Molex PN#: AFR-00458-BL (Keystone facing right)

		Item to be installed at: Cabinet 1 of FD cabinets
		Molex: Cable Glands Molex PN#: AFR-00473 Item to be installed at: Building Distributor & Floor Distributors
		Molex: Strain Relief Posts Molex PN#: AFR-00475 Item to be installed at: Building Distributor & Floor Distributors
		Molex: 45mm Splice Protectors Molex PN#: KFR-00008 Item to be installed at: Building Distributor & Floor Distributors
		Molex: MLX Adaptor plate loaded with 24 x LC duplex SM blue couplers. Molex PN#: AFR-00454-BL (Keystone facing up) Item to be installed at: Floor Distributors
	*Splice Tray to fit Fibrenet Enclosure. *Blanking plates to fit Fibrenet Enclosure. Item to be installed at: Building Distributor	Molex: Fibre Splice Tray (Pk of 2) Molex PN#: AFR-00470 Item to be installed at : Building Distributor & Floor Distributor
Connectors / Thru Adaptors	External:	Internal:
	Commscope Netconnect -2m SM APC pig tails Commscope Netconnect PN#: (9-1568272-1) Item to be installed at : Building Distributor & Floor Distributors	Molex: LC Pigtails OS2 (PK of 6) Molex PN#: 91.L0.832.00B00-6 Item to be installed at : Building Distributor & Floor Distributors

A3- Perspex Record Sheet Holder	Krone PN#: KROWMDFRBH	
Record Sheets	Krone PN#: KROWDF	
Voice Frames	Profil Krone and Netconnect are recommended. (66-way frames for CD's & BD's as a standard. FD's will utilize a 55way frame at minimum)	
10 pair IDC Modules	Krone and Netconnect are recommended. Note: Numbering of each Krone/Netconnect strip is mandatory e.g '0' on the left of the first strip and '10' on the right, '1' on the left of the second and '20' on the right etc.	
Telephone Cable	External:	Internal:
	100Ω Multipair Outdoor Gel filled cable to the pair count required (Cat 3 min). See line diagrams for sizing and locations.	100Ω Multipair Indoor cable to the pair count required (Cat 3 min). See line diagrams for sizing locations.
Cable organisers/ma nagers (Ring Runs)	1RU Deep Horizontal Ring Run Molex – PN#: 25.B035G	
Infrastructure Support		
Cable Basket/ Wire/ Mesh	Wire Basket is to be installed unless otherwise stated. Size of each basket run will be detailed in the project Specification.	

END OF DOCUMENT