UNSW Communications Services Design & Installation Standards

Never Stand Still

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(Interim version with updated part numbers, Standards of Compliance & Wireless Design)

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Revision History

Version	Document Status	Date	Author
4.18	Consolidation of Communications Specification for the UNSW - UTP V2.11, Backbone V2.7, Contractors V1.5.	15th May 2015	ITCS
4.19	Various materials updated/changed.	14th July 2015	ITCS
4.20a	• Sections sequence swapped to enhance flow. • Various wording changes and additional images/diagrams to improve clarity. 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,	3rd June 2016	ITCS

	new example methods & drawings. Confirmation of requirements by Facilities 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.		
4.20.1	• Updated part numbers, Standards of Compliance & Wireless design.	29th July 2020	ITCS

Interpretation of Terms

Term	Description
ACMA	Australian Communications & Media Authority
Active Network Equipment	The active equipment required to operate the University's data network. These devices provide transient services and include switches, routers, wireless access points and digital media players. All such equipment to be connected to the UNSW data network is supplied by ITCS.
Approved/authorised in writing	Paper or email authorisation/approval has been issued by ITCS.
AS/NZS	Australian Standards/ New Zealand Standards
AV	Audio Visual
Backbone Cabling	Provides interconnection between the Building Distributor and Floor Distributor.
BMS	Building Management System
Builder	The builder or Head/Managing Contractor for the project.
Building Distributor	The distributor between the Campus Backbone Cabling and the Building Backbone Cabling.
Campus Backbone Cabling	Provides interconnections between the Campus Distributor and the Building Distributor.
Campus Distributor	The head end/s of the Campus backbone cabling system.
CET	Communications Earthing Terminal

CES	Communications Earthing System
Communications Infrastructure	All passive and active components of the UNSW communications plant.
Communications Room	Equipment rooms reserved to house communications cabinets, cabling and active equipment. The Campus Distributor, Building Distributor and Floor Distributors are housed in Communications Rooms.
CRS	Computer Room Solutions
db	Decibels
DMP	Digital Media Player
Contractor	The contractor or subcontractor company awarded the contract for supply, installation & certification for UNSW communications systems requested in the Overall Project.
Emacs	Energy Management and Control Systems
External Telecommunications Providers	Public telecommunications organisations providing services to UNSW.
Facilities	The UNSW Facilities Department
FIP	Fire Indicator Panel
FFL	Finished Floor Level
Floor Distributor	The distributor between building backbone cabling and horizontal cabling.
GPO	General Purpose Outlet
Horizontal Cabling	Connects the Floor Distributor to telecommunications outlet in work areas.
IBC/DAS	In Building Coverage / Distributed Antenna System
IDF	Intermediate Distribution Frame
IEC	International Electro Technical Commission
Industry and vendor's standards.	The standards listed in Section 4. The cable vendor installation standards.
ISO	International Organization for Standards
ITCS	UNSW IT Communications Services.
ITCS Engaged	Formal engagement of ITCS has been secured via a Requisition for Works & Services.
Major Works	Construction works classified by UNSW Facilities as Major Works.

MATV	Master Antenna Television
Other Services	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.
MDF	Main Distribution Frames
MMF	Multimode Fibre
PN	Part Number
POE	Power Over Ethernet
Principal	UNSW Facilities FM Planning or the Principal's authorised agent.
Project/Overall Project	The entire project from initial planning through to occupation, including all works to complete the project.
Project Specification	The Specification that describes the particular design and installation requirements for each project.
Project Team	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, *submit to the project or project team* means submit via the approved communications channels to the most appropriate recipient.
RWS	UNSW IT Requisition for Works & Services. Submission by registered party is required to formally engage ITCS.
RU	Rack Unit
STP	Shielded Twisted Pair
SMF	Single Mode Fibre
The Works	The services and goods to be delivered by the Contractor.
The network	UNSW IT Communications Services voice & data network.
To be submitted	Information to be submitted to ITCS via the agreed communication channel for the specific project, unless otherwise advised in this document.
UNSW	The University of New South Wales.
UNSW FM	UNSW Facilities Management
UNSW IT	The UNSW IT Department
UNSW IT Data Connection Policy	IT Policy & Guidelines – Data Connection Policy

	https://www.it.unsw.edu.au/staff/policies/index.html#OtherITrelatedPolicies
UNSW Network	UNSW IT Communications Services voice & data network.
UPS	Uninterruptable Power Supply
"Vendors" certification program	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.
VLAN	Virtual Local Area Network
WAP	Wireless Access Point

1. Overview

1.1. Introduction

This document describes the standards to be applied during the design and installation of the UNSW Network. All network cabling and associated works within UNSW campuses must comply with these standards in addition to current Industry and Vendor Standards.

It is mandatory that this document is incorporated in all Major Works project document packs to ensure that the finished product meets the specific needs of the University. This document is to be issued with the detailed design Specification describing the particular project and referenced, including version number, within the Specification. UNSW Facilities, architects, builders, services consultants and installation contractors are to be familiar with all sections of this document.

Deviation from the UNSW Communications Services Design and Installation Standards is not permitted without written approval from UNSW IT Communications Services (*ITCS)* prior to the procurement of materials and commencement of any works.

The latest version of this document is to be requested by the UNSW Facilities Project Manager at the commencement of building and communications services design for each Major Works project. It is for the use of the intended project recipients only and no other person or project. In the event that the information is disclosed and used by others, ITCS accepts no liability for any loss or damages resulting.

ITCS reserves the right to update and alter any part of this document throughout the project. Notifications of changes will be provided, and the document will be reissued to the project if changes affect the work being undertaken.

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1.2. Ownership

ITCS is responsible for the design, installation and ongoing operation of all UNSW campuses voice and data networks and associated infrastructure on behalf of UNSW and its members. With this responsibility comes the authority to take action necessary to safeguard the integrity of the network to minimise and contain potential risks to the University and its members. In order to maintain standards and consistency throughout UNSW campuses, ITCS is the only entity authorized to approve the

installation, relocation or decommissioning of communications passive infrastructure and network equipment connection. Refer to UNSW Data Network Connection Policy web page reference for additional information:

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

ITCS is to be notified, formally engaged by UNSW Facilities and invited to participate in all discussions/decisions that could affect communications services.

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 adjustments 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 Facilities, 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.

Switches and equipment within communications cabinets can only be installed or removed by ITCS personnel as per the UNSW IT Data Connection Policy. Wireless base stations and digital media players

may be removed by contractors when specifically instructed to do so by ITCS. All equipment removed by contractors (for example wireless base stations) is to be returned to ITCS.

Assistance can be provided by ITCS to arrange passive cabling to builder's 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 in order 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 design or 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 or other services ducts or risers. Communications Services 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 60% 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, 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 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.
- The entrance door to the communications room is to be wide enough allow 800mm x 800mm cabinets to pass through the opening, but not too large to prevent full door opening into the 1 metre reserved space in front of cabinets.
- 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 footprint in the building. This can be achieved by designing for larger, centrally located rooms servicing a number of floors rather than smaller rooms on every floor at the edges of the building. For example, a communications room housing one cabinet requires a minimum of 6.3m^2, two cabinets require 9.1m^2 and three cabinets require 12m^2. One cabinet in each of three communications rooms will consume 18.9m^2 and will necessitate duplicate mechanical and other services for each room. The final achievable quantity of communications rooms will be dependent on the total floor plate size, the communications room & riser locations on the floor and adherence to the cable length restrictions for communications cabling.
- 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.

- It is recommended that the Project confirms the expectations of the various building services providers/owners (e.g. security, BMS, energy monitoring) regarding their expectations of network service provision during power outages. This will inform the project decision on UPS/generator backup for communications equipment.
- If a UPS is required to support the uninterrupted operations of communications equipment, it is preferred that a separate building wide UPS system is provided. 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. UPS's are not to be installed in communications cabinets. Regardless of the location, UNSW Facilities will be responsible for ongoing UPS maintenance and refreshes.
- 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, AV, 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 changes 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-UNSW network services installed without written authority will be removed at the project cost.
- Communications cabinets are not to be used to house Security equipment, UPS or any equipment not installed and managed by ITCS.
- The minimum slab to soffit room height is 3 metres.
- Ceilings are not permitted in communications rooms as per AS/NZ3084 standard.
- Internal plasterboard walls or similar used as a lining for concrete walls are not to be installed in communications rooms.
- 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.

2.3. Communications Risers Design

The following are general guidelines for communications riser design in UNSW buildings. The most appropriate riser location will depend on the architectural design of the building, the communications room location and dimensions, the communications room layout, the ability to vertically stack through all levels, access via public spaces and the location of other services risers/ducts.

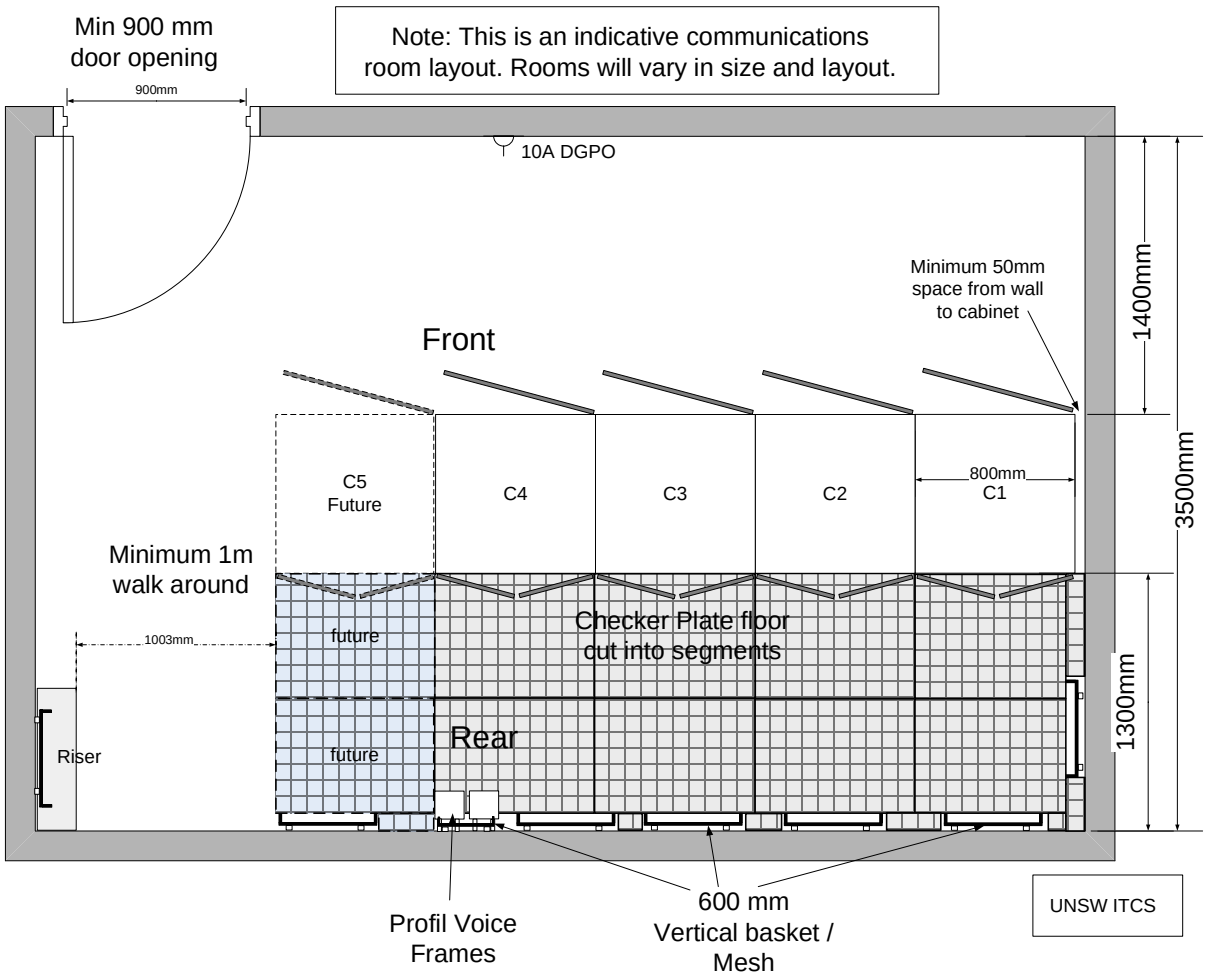
- A single, straight vertical riser is to run through the edge of every communications room (in each stack) from the lowest to the highest floor.
- Risers and slab penetrations must be sized to accommodate the quantity of communications cables to be installed on construction completion, plus a minimum of 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.
- Conduit penetrations through the slab are acceptable as long as the overall penetrations provided are of sufficient size to accommodate all installed cables and penetrations and conduits are provided for 60% spare capacity as per the point above.
- 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 if there is no communications room on that floor. For example, if communications rooms are on alternating floors, the riser must open on to a public space, such as a corridor or open area on those floors where there is no communications room. 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 voice and data network cabling and cabinets are not to be installed in 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 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 size of each riser is directly related to the number of communications ties and 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 user requirements. Riser sizes must adhere to AS/NZS 3084 and UNSW Communications Services Design & Installation Standards.

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.
- 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.
- 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 is to be located near the MDF/IDF or as specified.
- Floor Distributor cabinet power is to be provided via a 20amp captive outlet and the Building Distributor cabinet/s via 2 x 20amp captive outlets suspended/mounted above each cabinet. One double 10-amp GPO for general use is to be wall mounted opposite the front of the cabinets or as specified.



Note: Each communications cabinet will have a 20A dedicated captive outlet (mounted above).The Building Distributor cabinet will have 2 dedicated 20A outlets.

Diagram 1

2.5. Wireless Design Considerations including Ceiling Types

The number of wireless base stations (WAP) 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 base stations are to be included in the communications design and installed as part of the construction project. Unless advised otherwise, the wireless base station units are to be installed following construction completion. The wireless design is to adhere to the most recent industry standard. 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.

General Use AP Density Location Guidelines

General use density may include most office spaces, standard research laboratories, tutorial rooms, corridors, common areas.

- 1 device per 2.5m^2 (or more depending on the space).
- RSSI is >-67dBm
- SNR is greater than 20
- Noise is below -90dBm

High Density AP Density Location Guidelines

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

- Location with 1 user device per <1m^2
- Inter AP distance is < 15m
- RSSI is -62dBm
- SNR is greater than 25 (28 ideally)
- Noise is below -90dBm (ideally between -100 > -90)

Other types of spaces may include:

- Student housing.
- External.

The wireless design is to be provided by or approved by ITCS and is to include the following:

- Floor plans showing the proposed location of each wireless base station outlet & base station 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, post grad students, administration staff, academic staff, research staff, general 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 base station mounting method for each base station.
- AutoCAD drawings of the final floorplan with the wireless layout is 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 base station density is not to be averaged across the floor or building. Each wireless base station 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 is to be fully investigated and included as part of the overall design. The external base stations/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 base station installation, future access or signal propagation. A degraded wireless service due to architectural design elements will not be accepted.
- Wireless base station 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 base stations and outlets.
- Alternative accessible base station 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 base stations 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.
- Base stations/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.
- The base station is 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 base stations at the nominated location on completion of the construction stage.
- Base stations outlets and base stations must be fixed securely. Base station 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 base station on rods below the slab, custom

mounting above or below bespoke ceilings. Architectural approval may be required for surface mounted base stations.

- A different model of base station is often installed in student housing/accommodation rooms and the wireless design is to be adjusted to suit.

- UNSW ITCS will supply all Wireless Base Stations. If installed prior to building handover, approved contractors will install the base stations to the UNSW specified standard. UNSW will provide the specific mounting and documentation instructions for the base stations 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 base station/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 (IBC/DAS) infrastructure is to be installed during major construction works associated with a new or refurbished building. The total design is to be approved in writing by a major mobile carrier nominated by ITCS and is subject to final approval by ITCS prior to installation. Adequate space for cable termination, service providers' active equipment and the DAS riser is to be provided in the building.

The project may limit installation to the DAS component only during initial construction and review coverage on project completion. If the coverage throughout the building meets the acceptable level of 3 bars coverage measured at -79dbm, the IBC component may not be required. If IBC is required, it will be a project cost and require a project budget following building completion.

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 or multimode 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 or multimode 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 or multimode fibre installation from a dedicated fibre panel in Floor Distributor Cabinet 1 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.

2.8. Internal Building Cable Reticulation Design

Communications cable installation methods must adhere to all current UNSW, Industry and Vendor Standards.

- 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, store rooms 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 is to be via wire cable basket (minimum side depth 50mm). This would normally be installed above an accessible ceiling, but may also be installed in areas without ceilings. “Lock in” type ceilings are not to be installed 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 40% fill with 60% 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.
- 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.

Occasionally building occupants request the installation of an internal, standalone communications network within one or two rooms for specific teaching purposes. Those networks will not connect to the wider UNSW communications network. Any proposal for this type of network installation is to be submitted for prior review and written approval by ITCS as full requirements analysis may offer other available options. Internal communications cabling networks are not to be connected to UNSW communications rooms, cabinets or cabling. The cable is to be supported via separate infrastructure that is physically remote from the UNSW network infrastructure and the cable colour is to be different to the UNSW network communications cabling within the building. Outlet colour, basket/catenary and cable labelling should uniquely identify the infrastructure as a special isolated network and note the responsible school, department or group. Internal networks are not to connect via equipment or cabling to the UNSW Communications Network. At no time will the Private Network be permitted to bridge, connect or be shared in any way with the UNSW Network. Refer to UNSW Data Network Connection Policy web page reference:

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

Refer to Section 6 for additional information on cable reticulation.

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

ITCS designs and manages the installation of all communications cabling within UNSW campus boundaries and maintains the relationship with external telecommunications providers that supply services to UNSW. All contact with external telecommunications providers must be via authorised ITCS staff unless written authorisation to the contrary is provided by ITCS.

The following points relate to the design of campus backbone cabling within UNSW campuses. See Section 6 for additional details on Campus Backbone cabling.

- External backbone cable designs must consider the implications for the network design and operation of the entire campus or sections of the campus as applicable. Backbone cabling designs will always extend, to some extent, outside the boundaries of the construction site.

- 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 at two separate entry points to the building. Only one of the conduits at each entry is to be used for the initial installation and the other left empty.
- All backbone cabling is to be supported on wire cable basket from the building point of entry to the wall near the terminating communications cabinet/frame.
- All external fibre and telephone backbone cables shall be labelled. Refer to Section 6.12 for details.
- ITCS has final design authority over all backbone cabling routes and connection to any existing services. ITCS reserves the right to nominate particular contractors to complete cable terminations connecting to existing UNSW infrastructure. All telephony jumpering and associated works are to be completed by contractors nominated by ITCS.
- Contractors must coordinate with ITCS prior to the installation or removal of any external cabling or cabling routes. Builders, contractors or other UNSW departments/groups do not have the authority to access/work in any communications rooms, risers or pits without the specific knowledge and approval by ITCS on each occasion.
- Communications conduits or pits are reserved for communications cables only. Other services are not authorised to use UNSW Communications Services infrastructure.

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. See webpage reference: https://www.it.unsw.edu.au/staff/policies/index.html#OtherIT-relatedPolicies)

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, EMACS, 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.

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 third party devices such as Digital Media Players or wireless base stations supplied by others to the UNSW service.

Devices that will form part of communications services overlay networks, such as wireless base stations and digital media players will be procured by ITCS.

The project is responsible for the provision of sufficient communications outlets for connection of all required building services.

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

It is recommended that the Project confirms the expectations of the various building services providers/owners (e.g. security, BMS, energy monitoring) regarding their expectations of network service provision during power outages. This will inform the project decision on the provision of UPS/generator backup 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 that 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 &/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 &/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.

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 &/or UNSW Facilities. 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 Consultant at the same time as it is issued to the Electrical 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 &/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; preliminary voice jumpering and final relocations; installation and commissioning of wireless base stations and DMP's 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 RWS (Requisition for Works & Services).

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 voice and 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 databases 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.

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 base station 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.
        - Base station mounting method for each base station. 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 electronically and on a USB 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.
        - 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.
    - Confirmation that the external communications services as-built drawings have been submitted to UNSW Facilities 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 &/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.
- 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) 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 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 that forms the basis for the preliminary network active design and equipment procurement. The confirmed date of the first data activation in the building (including services activations) is to be provided along with preliminary information at least sixteen (16) weeks (80 working days) prior to the first activation and approval of the procurement within two (2) weeks (10 working days) of receipt of the design from ITCS, so the equipment can be ordered. The design and procurement information to be provided is to include but is not limited to:

- The proposed start and completion date for the first data activation required (usually building services). Staging details if applicable.
- The planned date of building handover and the planned date of occupation by UNSW.
- Speed (bandwidth) per outlet.
- Connection type (SMF, MMF, RJ45) per outlet.
- Quantity of outlets per communications cabinet of each type of bandwidth and connection, including details of the high-speed network requirements with proposed traffic flows.
- The quantity of each type of outlet per communications cabinet to be activated for each type of building service (by VLAN).
- The quantity of each type of outlet per communications cabinet to be activated for the building occupants.
- The quantity of wireless base stations and other activations per communications cabinet.
- All the information above will be used to develop the preliminary network active equipment design and subsequent equipment procurement.

3.7. Building Services Activations Submissions

The detailed building services activation information (Security, BMS, Emacs, 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.
- For voice activations an RWS submitted by UNSW Facilities with all relevant details is required. For example, for lift phones, the UNSW lift numbers are to be provided by Facilities, 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 a number of 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 Facilities 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.
- 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 is 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 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 switch installation and activation; patching and activation testing; voice jumpering preliminary works; installation, activation and commissioning of wireless base stations and DMP's as required. As a general 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 within the building will be located in a Communications Room network cabinet. Third party switches, hubs, routers or any equipment designed to provide connectivity onto the UNSW network for more than one device is not permitted. It is mandatory that building services contractors requiring connection to the UNSW data network must review and comply with the UNSW Data Network Connection Policy, Network Devices, prior to services design. See webpage reference:

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

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

Pre-requisites	Responsibility	Lead time
Data/voice network services to builder site sheds		
Engagement: RWS from Facilities outlining all requirements prior to submission of the Telecommunications Provider purchase order or any cable installation.	Builder via UNSW Facilities	
Works: Varies for each setup. Appropriate forms & advice by ITCS can be provided on request.	Builder/ITCS	Varies
Active Equipment Procurement		
Engagement: Provision of information as per Section 3.6.	Builder via UNSW Facilities	Submit to ITCS minimum sixteen (16) weeks before first activation
Works: • Preliminary active design • Approval • Procurement	ITCS Facilities ITCS	
Data outlet activation to enable contractors to test building services		
Engagement: RWS from Facilities including activation date and information as per Section 3.7 above.	Builder via Facilities	Submit to ITCS six (6) weeks before 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 Builder/ITCS	- Two (2) weeks prior to first activation.
• Zone switch installation and activation and adequate field switches installed, activated and patched as per the information provided.	ITCS	

	ITCS	As per date requested by builder.
Fire Panel connection to UNSW Fire System		
Engagement: Requisition for Works & Services including confirmation that the fire services contractor has been engaged and provision of details on the location of the fire line.	UNSW Facilities	Minimum two (2) weeks before connection required.
Works:		
• Campus distributor voice backbone cabling installed and tested. UTP data outlet/s from communications cabinet to fire panel installed and tested. • Fire line jumpering to campus panel.	Builder	
• Nominated data outlet activated as part of overall building services activations.	ITCS/Fire Contractor	ITCS – 2 weeks from receipt of RWS and details (assuming fire contractor available).
	ITCS	
Lift Phone lines		
Engagement: Requisition for Works & Services, including the UNSW number for each lift marked on a floor plan.	UNSW Facilities	
Works:		
• Campus distributor voice backbone cabling installed and tested.	Builder	
• Lift phone lines setup, jumpering & hotline setup.		
	ITCS/Lift contractor	Minimum two (2) weeks from receipt of detailed RWS, assuming availability of lift contractor.
Help Points		
Engagement:	UNSW Facilities	

Requisition for Works & Services including the UNSW Help Point number for each marked on floor plan.		
Works:		
• Campus distributor voice backbone cabling installed and tested. • Help Points installed.	Builder	
• Help Point phone line setup, jumpering & hotline setup.	ITCS	Minimum two (2) weeks from receipt of detailed RWS.

Interruptions of Communications Services to any existing UNSW occupied areas

Engagement:		
Written notification of the proposed services interruption. RWS as required.	Builder to Facilities/ITCS	
Required Information:		
• Proposed date, time and duration of the service outage. • The exact services affected by location. • Affected user groups. • Detailed job specification & work method statements as required.	Builder Builder Facilities Builder	Minimum 2 weeks prior to outage.
Once approved in writing by ITCS:	ITCS	
• The proposed outage notification that will be issued to users.	Builder/ Facilities	
• Confirmation of IT Change Request submittal and approval. • Active network changes as required.	Facilities or Comms consultant ITCS.	

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

Engagement:

• Notify UNSW Facilities of power or mechanical outage start and finish date and time. • UNSW Facilities to issue standard power outage notification and notify ITCS PM. Facilities to issue mechanical outage notification to ITCS PM/s.	Builder Facilities	Minimum 2 days prior to outage.

Building Occupancy Voice & Data Activations

Engagement: RWS from Facilities including the first occupant activation date and information as per Section 3.8 above.	Builder via Facilities	Submit the date of the first occupation and duration allowed for activation to ITCS sixteen (16) weeks before 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 (current version) submitted.	Builder via Facilities	
• Detailed active design based on Relocation Form information. • Installation plan commenced. Schedule and resources confirmed.	Facilities	At least eight (8) weeks prior to the first occupancy.
• Processing of voice and data information to enable documentation, activation planning and work orders. • Equipment setup & installation, pre-jumper voice pairs, patch, test field activations. • Voice services relocations on the day of the move.	ITCS	
	ITCS	Commence approximately two (2) weeks prior to first occupation.

4. Standard of Compliance

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

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/NZS 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 11801.5	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/NZS 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
ISO/IEC 14763-2	Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation
AS/NZS 14763.3	Implementation and Operation of customer premises cabling – Part 3: Acceptance for Optical Fibre Cabling
AS/NZS IEC 61935.1	Testing of Balanced Communications Cabling In Accordance with ISO/IEC 11801 – Part 1: Installed Cabling
AS/NZS ISO 9001	Quality Management systems
AS/NZS IEC 60825.1	Safety of Laser Products - Part 1: Equipment classification and requirements
Design & Installation Standards	UNSW Communications Services Design & Installation Standards (most recent version).
Data Network Connection Policy	https://www.it.unsw.edu.au/staff/policies/index.html#OtherIT-relatedPolicies
The Project Specification	The communications specification prepared for the project.

Any variations or conflicts that may occur between documents are to be raised and resolved prior to work commencing.

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 3080, AS/NZS S009, AS/NZS 3084 and (ISO/IEC 11801). The contractor must also adhere to the Vendors Installation Guidelines.

It is a mandatory condition that the supervisor/leading hand of the communications contractor or sub-contractor 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.

5. Contractor Workmanship

This section covers information for contractors and sub-contractors in regards 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.

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.

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.

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.

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 communications services 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 below:

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

CRS Part #	Description	Quantity per rack
RF458080	Frame 45RU x 800mm deep x 800mm wide	1
MDP45800	Fully perforated Metal door 45RU X 800 Wide	1
MDB45800	Barn door 45RU x 800 wide-fully perforated	1 set
SP45800	Side Panel 45RU x 800 deep	2
LKPC-92268-LF	92268 Profile Cylinder	2
TP80880UNSW	Top panel 800mm x deep x 800mm wide 2 x 300mm x 100mm cut outs	1
VCM70/135	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 BOM with 15A Modelled plug & 16A Breaker.	1*

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.
- Rear rails can be excluded from the cabinet with the exception of the Building Distributor cabinet/s which requires rear rails.

- * 2 power rails & 2 x 20amp captive outlets are to be provided for the Building Distributor cabinet/s.

6.2. Internal Horizontal & Voice Materials

Material	Part #
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)	Cat 6A 500Mhz RJ45 AMPTWIST Shielded SL Series Jack - 180º Exit ***CommScope NETCONNECT – PN# 2153001-1***
Optional side entry Jack for skirting duct where bend radius could be compromised.	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 ***CommScope NETCONNECT* – PN#:1933668-3**
Cable organisers/managers (Ring Runs)	1 RU Deep Horizontal Ring Run (DRR) ***Molex – PN#: 25.B035G***
Voice Patch Panel	50 Port Voice Patch Panel, UTP, 1U - Pairs 3/6, 4/5 ***Molex PN# : PID-00145***
Voice Frames	**Profil** 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 2 min). See line diagrams for sizing locations.
A3- Perspex Record Sheet Holder	***Krone PN#: KROWMDFRBH***
Record Sheets	***Krone PN#: KROWDF***
Patch cables and fly leads	Patch leads (and occupant fly leads) will be provided by ITIP.

6.2.1. 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 Facilities on the quantity of communications outlets required within each substation. The requirements may affect the enclosure size and detailed design.

6.3. Backbone Fibre, Voice & Support Infrastructure Materials

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

<table>
<tr><th>Materials</th><th colspan="2">Part #</th></tr>
<tr><td rowspan="3">Single Mode

Optical fibre</td><td>External:</td><td>Internal:</td></tr>
<tr><td><u>Yellow</u> Sheath

Loose Tube. Typically, 48core

This cable will be a

Commscope Netconnect or a Molex approved cable.</td><td><u>Yellow</u> Sheath

Tight Buffered indoor / outdoor LSZH riser cable

<u>24 core:</u>

Molex PN#: AFOIR024OS1

<u>12 core OR (6 core HSRN):</u>

Molex PN#: AFOIR012OS1</td></tr>
<tr><td colspan="2">See line diagrams for sizing and locations.</td></tr>
<tr><td rowspan="2">Fibre Enclosure</td><td>External:</td><td>Internal:</td></tr>
<tr><td>Fibrenet: Enclosure: 3 RU

Commscope Netconnect PN#:

(1154033-3) RTC3G-0-96-FS

Item to be installed at:

Building Distributor cabinet.</td><td>Molex: MLX-1RU Multi-Function Fibre Enclosure

Molex PN#: RFR-00311

Item to be installed at:

Building Distributor & Floor Distributor cabinets.</td></tr>
<tr><td rowspan="2">Fibre Termination</td><td>External:</td><td>Internal:</td></tr>
<tr><td>Fibrenet: 12- Port APC plate

Commscope Netconnect PN#:

(2-1154033-3) RTCG Adapt plate SCA12Z

Item to be installed at :

Building Distributor cabinet</td><td>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</td></tr>
</table>

		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 OS1 (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.	
Telephone Cable	**External:**	**Internal:**
	100Ω Multipair Outdoor Gel filled cable to the pair count required (Cat 2 min). See line diagrams for sizing and locations.	100Ω Multipair Indoor cable to the pair count required (Cat 2 min). See line diagrams for sizing locations.
Cable organisers/managers (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.	

6.4. UNSW Reserved Cable Colours

UNSW Facilities 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 use pink, BMS is to use purple cable. Please refer to UNSW Facilities Design Guidelines for information on the approved colours for each service.

Please note: some UNSW Faculties/Schools request standalone, internal communications networks for teaching purposes. If such a network is requested by the building occupants and approved in writing by ITCS, the STP and fibre sheath colours are to be a different colour to the UNSW network cable colours. Selection of a cable and face plate colour that is not used by any other service is recommended.

6.5. Communications Room Layout

6.5.1. 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 1metre 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 60% 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 and 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.
- 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 confirmed 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 Facilities 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, 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 the Building Distributor cabinet.
- Ceilings are not to be installed in communications rooms.
- All room surfaces 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.

6.5.2. Active Equipment

Active equipment for services testing will be provided at commissioning stage by ITCS, but may be installed at any point during the Project. Active equipment for general building occupation will be installed following handover to the Principal.

All active network equipment is supplied, installed and activated by ITCS. All active equipment will be located in a communications room network cabinet. Third party switches, hubs, routers or any equipment designed to provide connectivity onto the UNSW network for more than one device is not permitted. It is mandatory that all contractors installing building services requiring connection to the UNSW data network review and comply with the UNSW Data Network Connection Policy, Network Devices, prior to services design. See webpage reference:

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

6.5.3. Power

A dedicated 20 Amp screw covered power point is to be provided above each communications cabinet. The Building Distributor cabinet is to be provided with two (2) 20 AMP screw covered power points above the cabinet. Captive outlets are generally suspended from the slab using a pendant style GPO or mounted directly to a unistrut running along the length of the ganged cabinets. Both methods of installation are to be mounted no higher than 400mm from the top housing of the cabinet. Provide a wall mounted double GPO, flush mounted on the wall directly in front of the row of cabinets for general use.

6.5.4. 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.

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

Generic communications room layout.

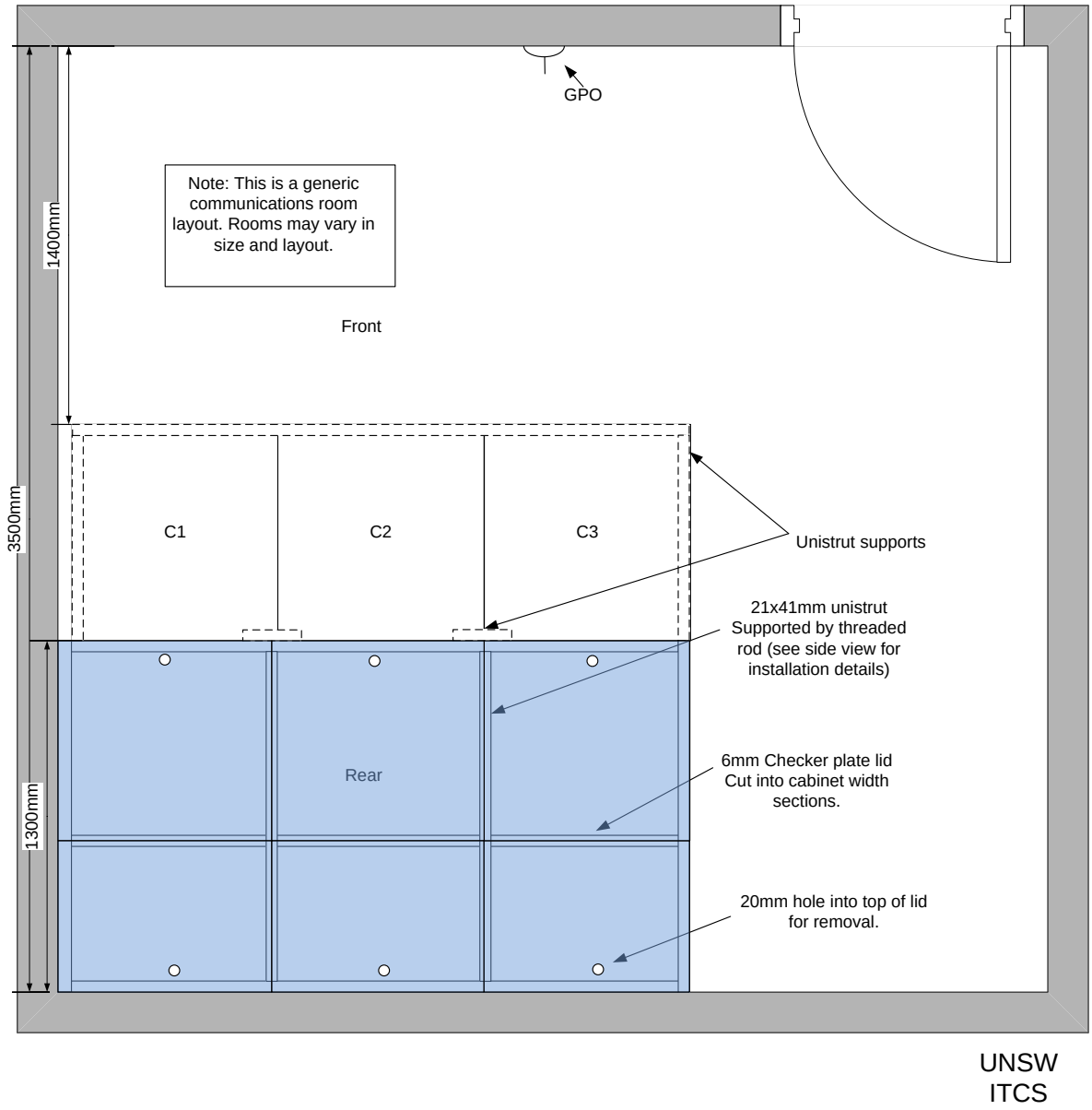


Diagram 1

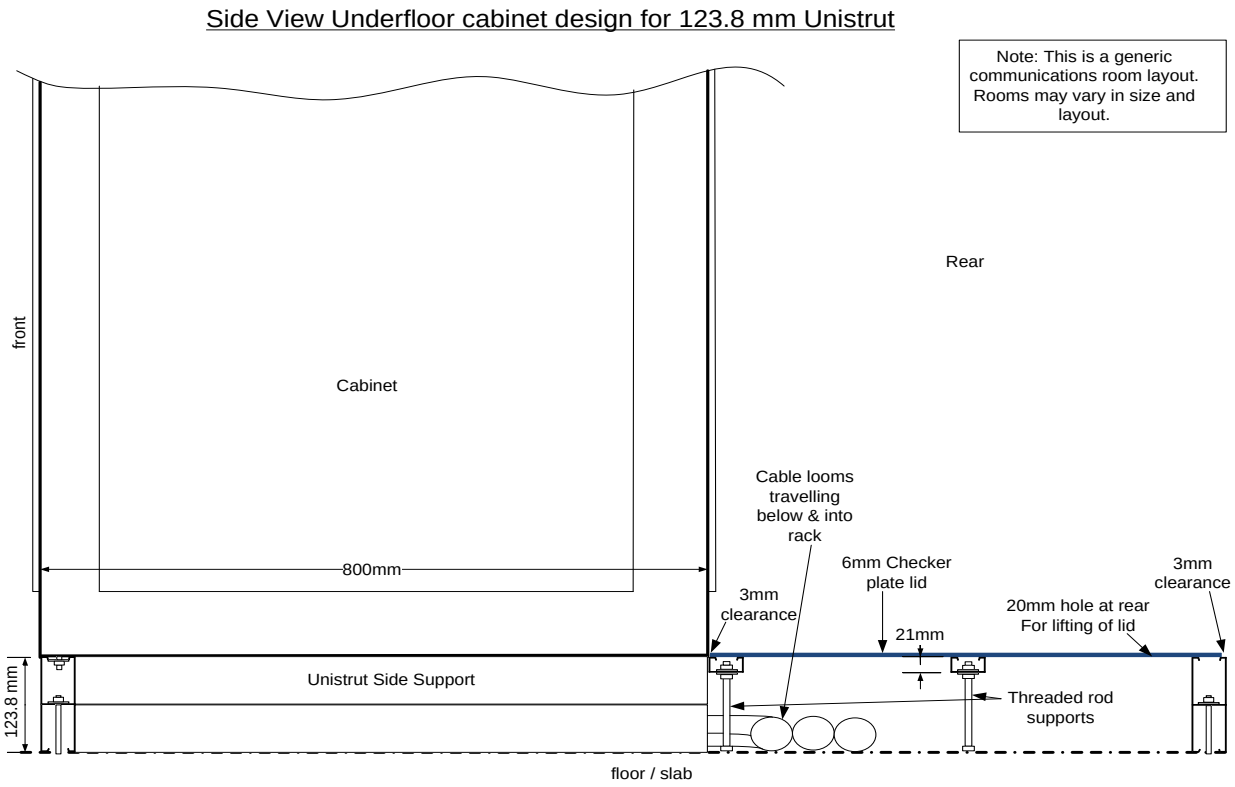


Diagram 2

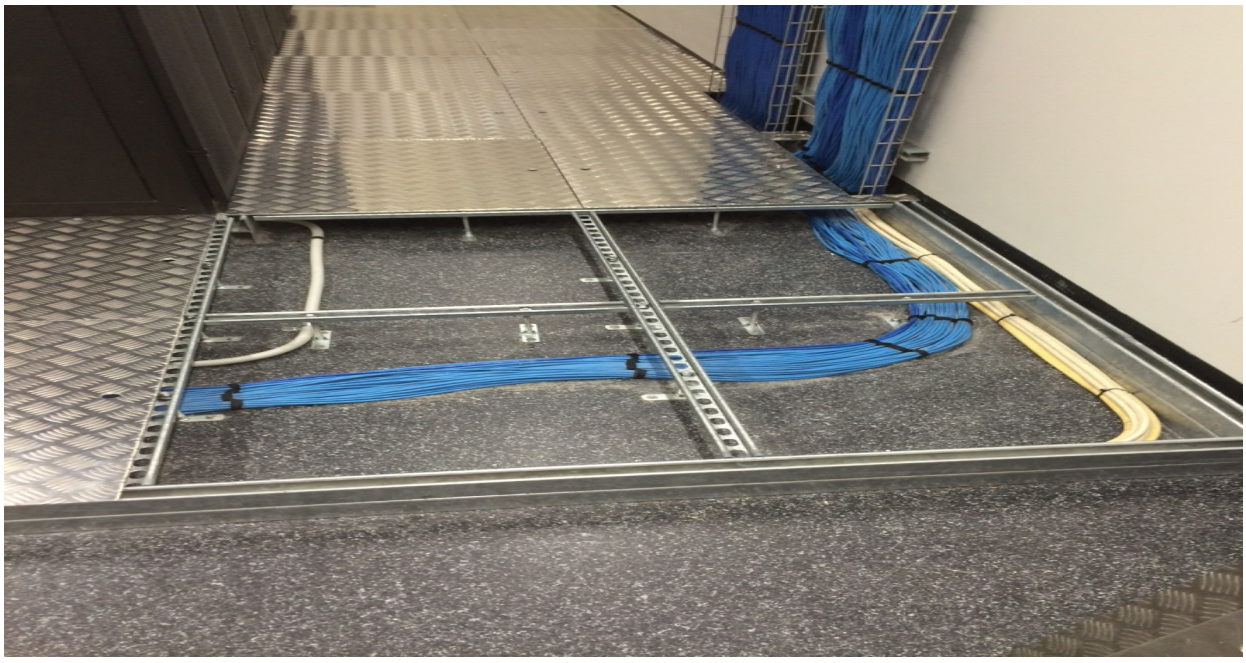


Diagram 3

6.5.5. Cabinet Configuration & Indicative Cabinet Layout

- All patch panels and patch cable supports shall be installed inside an equipment cabinet as per the cabinet layout provided by ITCS.

- All termination equipment and ring runs shall be mechanically secured in the cabinet with the supplied appropriate bracket, adaptor, fixing screws and capture nuts.
- All cabinets shall be solidly affixed to their supporting structure.
- One or two dedicated 20A power circuits must be provided as detailed in Section 6.5.3.
- Sufficient loom should be left to allow the patch panels and fibre panels to move around the cabinet (provided 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, fibre panels must have sufficient loom to enable removal from the cabinet to a table in front of the cabinet so additional terminations can be completed. Due to the potential volume of cable looms, the appropriate management method for each installation should be discussed with ITCS on site prior to installation.
- Proper supporting devices such as cable baskets shall be used to organise cables with appropriate cable Velcro straps to prevent strain on the cables due to gravity. Looms should not be placed so as to obstruct the installation of any further 19 inch rack mount equipment.
- Cables shall be dressed and terminated in accordance with the recommendations made in AS/NZS 3080, the certifying body and best industry practice.
- All communications cabinets are to be labelled on the frame (not the door). For labelling information see Section 6.12.
- The current CRS cabinets are 46RU with 45RU used. The RU numbering provided by the manufacturer should start at RU2 ie. RU1 is not numbered, RU2 is numbered 1. Please advise prior to installation if this is not the case. Special note shall be taken to install termination equipment at the correct RU within the cabinet. For a typical Floor Distributor cabinet layout see *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 for each project and the layout is not the same as the Floor Cabinet. A specific Building Distributor cabinet layout approved by ITCS is to be provided

for each project. The layout of Cabinet 1 in each Floor Distributor may vary to accommodate HSRN requirements.

6.5.6. 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.

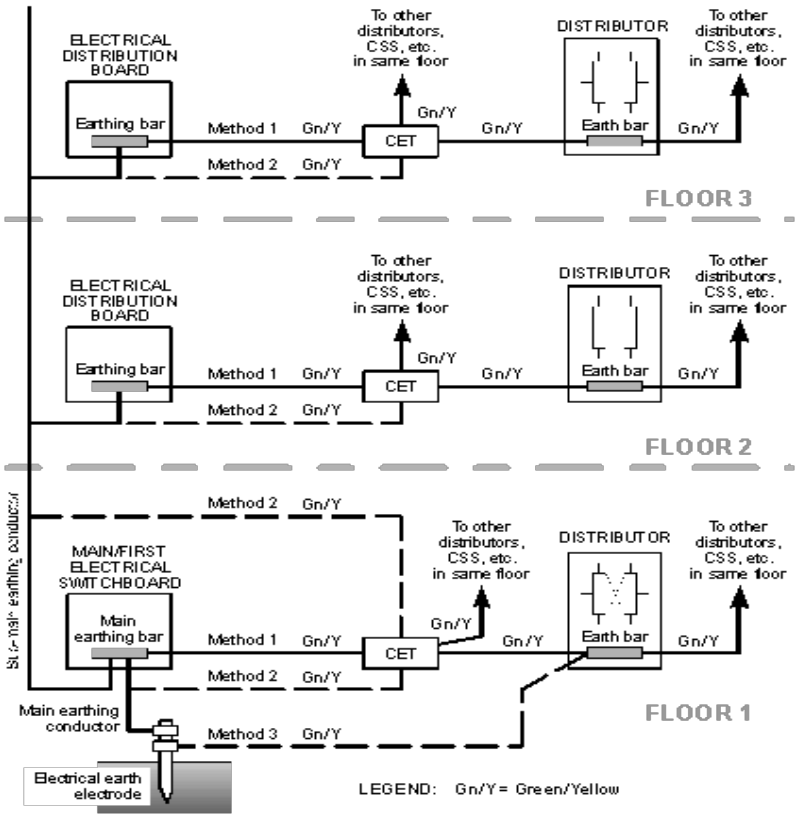
Frames of all metal casing which include equipment chassis, enclosures, raised metal floors and cable trays shall be adequately earthed. Earthing stud termination shall be provided for connection to the earth system. Earth protective conductor size and maximum resistance shall be in accordance with AS/CA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

The earthing system shall be designed and/or approved by a qualified PE, 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.

6.6. 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 60% spare capacity. More than 60% 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 60% 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.

6.7. Campus Backbone Route Installation

Construction of a new building will usually require the installation of two external diverse cable routes from existing communications pits to new pits just outside the building and from there into the building. In addition to the installation of these normally short routes there may be a requirement to install more extensive or remote new cable routes.

Installation of new routes will be detailed in the project Specification. Written approval by ITCS is required prior to the design completion or installation of new external communications routes.

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

- New external communications routes are to be documented in full and submitted for written approval to ITCS and UNSW Facilities.
- All communications conduits are to be white and of a minimum size of 100mm. Multiple 100mm conduits may be required.
- A draw rope is to be left in every conduit.

- 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 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 will be backfilled with fine sand, such that the sand provides a minimum 100mm bed 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 x450mm. Exact dimensions will vary depending on the installation.
- 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 will be guarded by approved safety barriers.
- As-built drawings are to be submitted to ITCS and to UNSW Facilities on completion. The drawings should include the location of the route, conduit depth, number and size of installed conduits, pit locations and size.
- UNSW Facilities is responsible for updating & issuing the revised Site Services drawings to ITCS for review.

6.8. Campus Backbone Cabling System

ITCS designs and manages the installation of all communications cabling within UNSW campus boundaries and maintains the relationship with external telecommunication providers that supply services to UNSW. All contact with external telecommunications providers must be via authorised ITCS staff unless written authority to the contrary is issued by ITCS. If works by one or more external telecommunication providers is required there could be a lead time of many months.

There is an existing, extensive UNSW communications voice and data campus backbone cable infrastructure system installed throughout Kensington campus and between and within other UNSW campuses, hospitals and affiliate organisations.

At Kensington Campus there are a number of fibre rings comprised of 48 core or 144 core OS1 or OS2 fibre with a yellow sheath. See Section 6 for materials information.

- Contractors must coordinate with ITCS prior to the installation or removal of any campus backbone cabling. Builders, contractors and other UNSW departments/groups do not have the authority to access or work in any communications rooms, risers, conduits or pits without the specific knowledge and approval by ITCS on each occasion.

- Communications conduits and pits are reserved for communications cables only. Other services are not authorised to use communications services infrastructure.
- Campus backbone cable must be installed in nominated communications conduits and pits (either existing or installed as part of the project).
- It is the responsibility of the contractor to confirm the suitability of the cable route and pits for the requirements of the project, the condition of the conduit and pits and the spare capacity for future installations. If the conduits/pits will be close to capacity on completion of the project this must be reported to ITCS during the design stage and prior to works commencing.
- 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 slot into an existing fibre ring serving a number of buildings if there is sufficient capacity. The particular 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 will 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 at 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 other left empty. Please note: the size 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 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 up from the external pit as they enter the building.
- UNSW Facilities site induction, detailed designs, work method statements and written approval by ITCS are required prior to any work in the voice or data Campus Distributors or any communications rooms outside the limits of the construction project.
- All backbone cabling is to be supported on wire cable basket from the building point of entry to the wall near the terminating communications cabinet/frame in the building distributor.
- A 15m metre loop is to be coiled high on the wall of the terminating communications room. The exact location of the coil is to be approved by ITCS.
- The following label or similar shall be fixed along the fibre cable route 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 closest visible location just inside the destination building. Labelling is to include the following:

From "Building Name" - Room "# "– To "Building Name" - Room "#"

Type (Single Mode or Multi Mode and Make) & Core count

Installed by : "your Company name"

See Labelling Section 6.12 for detailed information.

- ITCS has final design authority over all backbone cabling routes and connection to any existing services. UNSW reserves the right to nominate particular contractors to complete cable terminations connecting to existing UNSW infrastructure. All telephony line jumpering and associated works are to be completed by contractors nominated by ITCS.
- Installation of campus backbone cabling must adhere to all industry, vendor and ITCS standards listed in Section 4.

6.9. The Internal Building Backbone & Floor Cabling System

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

In general, the system will utilise Category 6A, star wired horizontal cabling with RJ45 outlets and possibly some fibre outlets to the desktop. The building backbone will utilise both Category 6A cabling and single mode fibre cabling. The specific cables to be installed are listed in Section 6 Materials.

The entire data communications project is to be covered by the Vendors Certification 25 year warranty. Toward completion of each project all test results along with the warranty certificate shall be presented to ITCS for approval.

6.9.1. 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, AV, 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. 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%.
- 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.

6.9.2. 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

6.9.3. 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.

6.9.4. Floor Boxes

Cabling to floor boxes must adhere to the manufacturer's standards. The floor box must be fit for purpose, bend radius limits are to be maintained and all outlets labelled.

6.9.5. 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.

6.9.6. 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.

6.9.7. Fibre Optic Installation

Fibre installation standards are to be read in conjunction with all of Section 6.9 as well as 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 per floor 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 concerns that should be addressed during the installation of optical fibre include.

- Pulling Tension – ensure the manufacturer's pulling load is not exceeded during installation. Failure to do so may cause breakage of the fibres that may not been seen if the outer jacket remains in tack.
- 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 – avoid treading on the cable or exposing it to other forms of compression. Local compression points will cause local increases in insertion loss or 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 installations to desktop field location should be reticulated via cable basket to the closest point then via flexible conduit to the outlet location or as outlined in the project specification. Reticulation methods may vary.
- 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 is alive with radiation and handle it with respect, unless you personally know it to be safe.
- All campus and building fibre optic infrastructure installed within the building shall be secured using Velcro straps. Cable ties are not accepted.
- All fibre optic cables installed under floor in communications room shall be mechanically protected with the use of corrugated conduit affixed at appropriate intervals. A "Caution" label shall be affixed to identify the underfloor cable. See section 6.12 for specific labels.

6.10. Infrastructure Termination

All cabling Installation and termination shall comply with AS/CA S009, AS /NZS 3084, AS/NZS 3080, 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.

6.10.1. The Campus Backbone (External) Fibre Optic Cable Termination

The Campus Backbone fibre ring is comprised of 48 core or 144 core OS1 or OS2 fibre segments with a yellow sheath and is to be terminated on a Fibrenet Enclosure.

- Detailed splicing and 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 ring is required upon completion of cable installation or termination changes to any part of the ring.
- Both ends are to be terminated as an APC (Angled Polished) Connector.
- A 15m loom shall be coiled on the wall within the Building Distributor room of each building to allow for future maintenance and possible re-termination.

6.10.2. 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 OS1 or OS2 riser cable with a yellow sheath.

- At the Building Distributor (lead-in) cabinet, internal fibre ties to each Floor Distributor cabinet are to terminate in a 96 core fibre optic break out tray. The preferred core reticulation method is illustrated in Image 1.
- At the Floor Distributor cabinets, the internal fibre ties are to terminate in a 48 core fibre optic break out tray. See the preferred core reticulation method illustrated in Image 2. The vendor's Installation Guidelines for termination and testing shall be observed.
- Both ends are to be terminated as LC.
- In the Building Distributor cabinet, the internal fibre ties are to have a 2m loom that is coiled nearby, outside the cabinet. The appropriate method will 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 vertical tray (adjacent to switch location).

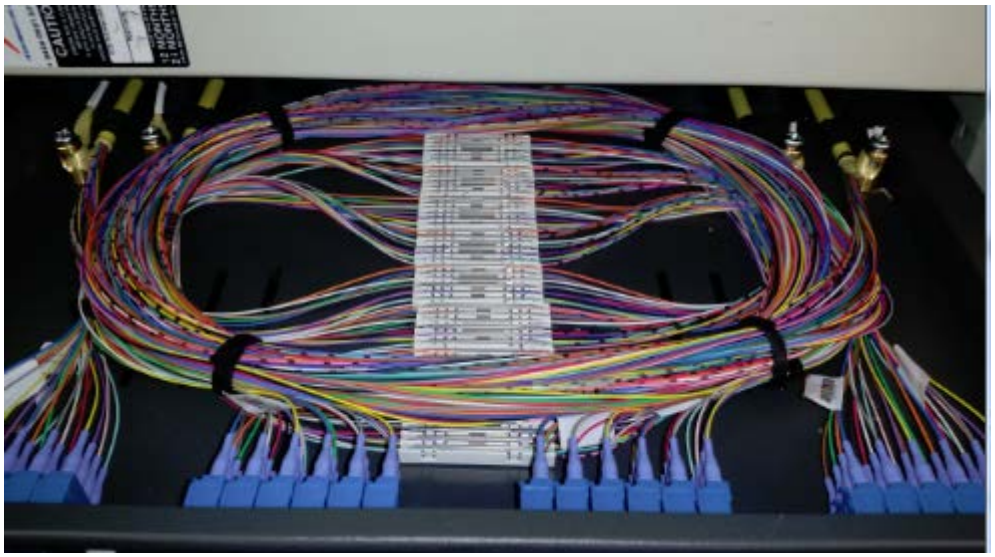


Image 1 - 96 core high density fibre optic breakout tray in Building Distributor cabinet

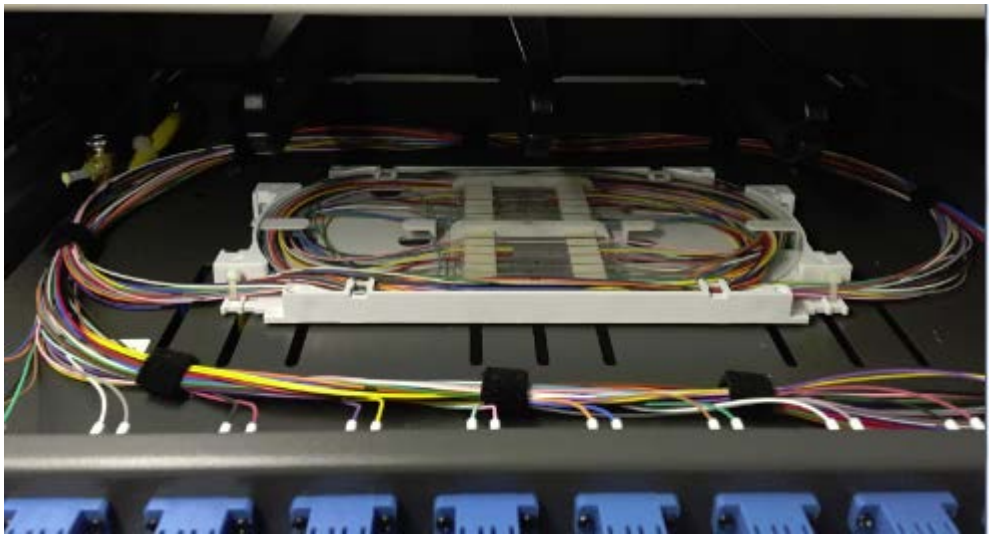


Image 2 - 48 Core Fibre Optic Breakout tray in Floor Distributor cabinet

6.10.3. 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.
- 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.
- 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.

6.10.4.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 bending radiuses and stress on cables is kept within the vendor's installation limits. Cabling installed in communications cabinets for termination onto patch panels shall be mounted according to the standard cabinet layout in this document. The final cabinet layout for each project is to be approved by the ITCS project representative prior to the commencement of patch panel terminations.

6.10.5.Voice Panel Termination

Unless otherwise advised, voice panel terminations shall be completed in a numerical fashion top to bottom - (1-25 top, 26 to 50 bottom). Telephone cable will be installed from the nominated voice frame direct to the voice patch panels as 2 wire terminations. The site specific cabinet layout authorised by ITCS will indicate the RU location.

6.10.6. 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.
- Usually the backbone cables will terminate on the left frame. This frame is usually labelled "A". The right frame will house cabinet ties.

- UNSW reserves the right to witness any testing of voice cabling.
- All Records will abide by as AS/NZS 3085.1, AS/NZS 3080 and any standard nominated in this document.
- Record Books are to be provided and the information updated at all voice frame locations.

6.10.7.Consolidation Points and Muto's

Use of either Consolidation Points or Muto's without the written approval of ITCS is not permitted. Installation of such termination equipment without written approval will result in removal at the project cost.

6.11. SCC (Special Circumstance Cabling)

6.11.1.Lift Phones

Lift Phone cabling is an integral part of the overall cabling system of a building. As part of UNSW policy, all 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.

6.11.2. Security Help Points

Security Help Points are part of the campus safety program and combine Security and Voice services. A Security Help Point may be located internally or externally.

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.

The voice cabling shall terminate at the nearest IDF or MDF for the floor or the building. The cable/s 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 locations and security cabling requirements are to be provided by UNSW Security.

6.11.3. 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.

6.11.4. 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.

6.11.5. Building Services

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

Communications outlets for control equipment such as Security access control, BMS, EMACS, monitoring and AV must be terminated as a standard wall outlet external and adjacent to the control device.

6.11.6.CCTV Security Cameras

Unless otherwise advised by UNSW Security, cameras will be connected via communications infrastructure to the Floor Distributor communications cabinet serving that location. Cameras will be patched to Power over Ethernet (PoE) switches, power injectors 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 in or 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. See webpage reference:

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

6.11.7. IBC/DAS Mobile Phone Coverage

- In building mobile phone coverage (IBC/DAS) infrastructure is to be installed during major construction works associated with a new or refurbished building. The total design is to be approved in writing by a major mobile carrier nominated by ITCS and is subject to final approval by ITCS prior to installation. Adequate space for cable termination, service providers' active equipment and the DAS riser is to be provided in the building.
- The project may limit installation to the DAS component only during initial construction and review coverage on project completion. If the coverage throughout the building meets the acceptable level of 3 bars coverage measured at -79dbm, the IBC component may not be required. If IBC is required, it will be a project cost and require a project budget following building completion.
- The cable reticulation routes and supporting infrastructure as well as the proposed location and space requirements for the active equipment is to be considered and documented during the building design phase.

6.11.8. 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.

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

6.11.9. 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 is classified as above 1000v for Alternating Current and at least 1500v for Direct Current.

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

The three acceptable forms for the installation of Optical Isolation are:

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 with a 2 metre space between the two enclosures.

The preferred installation type is Method 1.

The installation methods are:

- 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. The secondary with in the HV substation. (See 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 with 2m of the LV side. A link between the two enclosures will need to be established via a penetration or a secured conduit. (See 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, Facilities Management will provide feedback on acceptable mounting locations. (See Example 2 below).
- The boxes will be earthed according to AS/NZS 3000, Electrical Wiring rules.
- A 10A double GP0 is to be installed within both box locations.

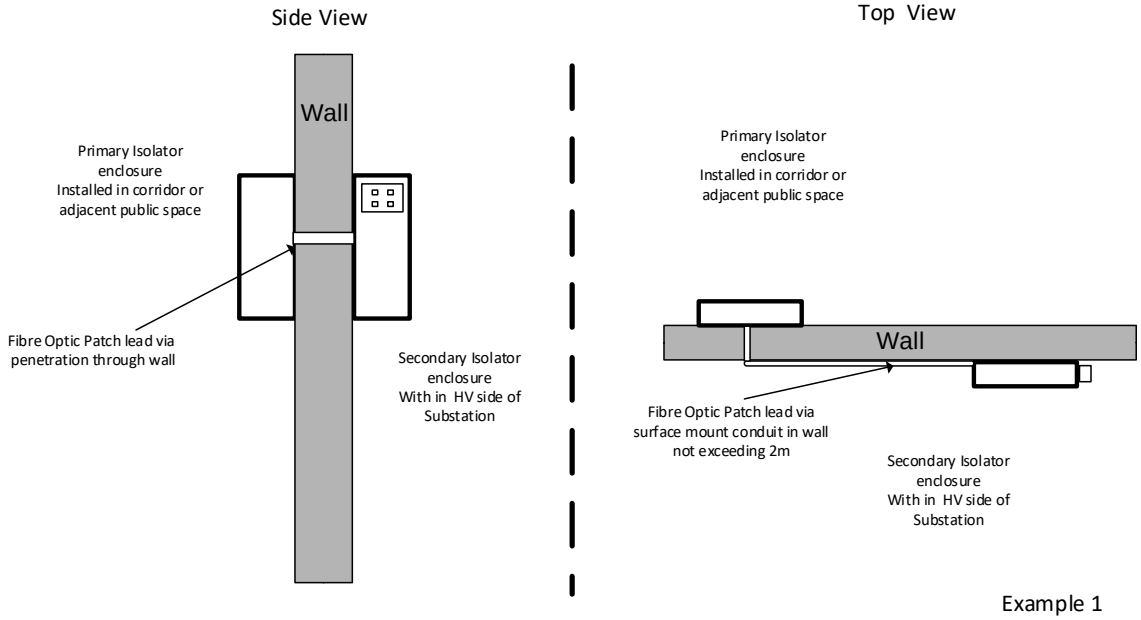
- A minimum of 2 x Fibre Optic patch leads will link both Optical Isolator units. A label will be included to indicate each of the fibre leads. (Patch leads shall be installed in a conduit where exposed).
- 4 x 10/100 Base –TX to 100 Base – FX Bridge Media Converters.
- A minimum Quad data outlet emanating from the appropriate communications room floor 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. (See example 3 below).

Please note:

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

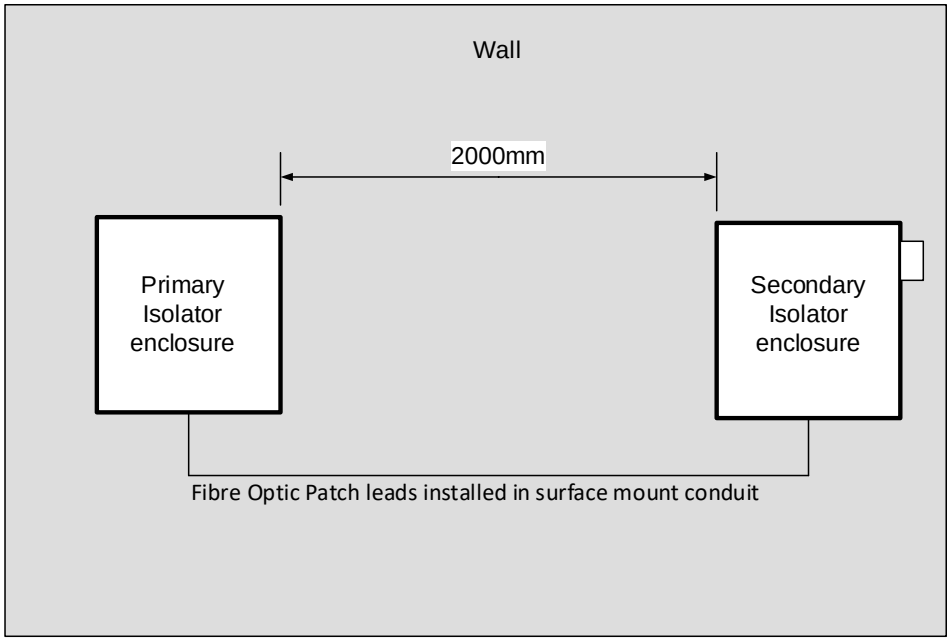
The diagrams below are examples of typical installation methods:

Method 1 & 2
Back to back



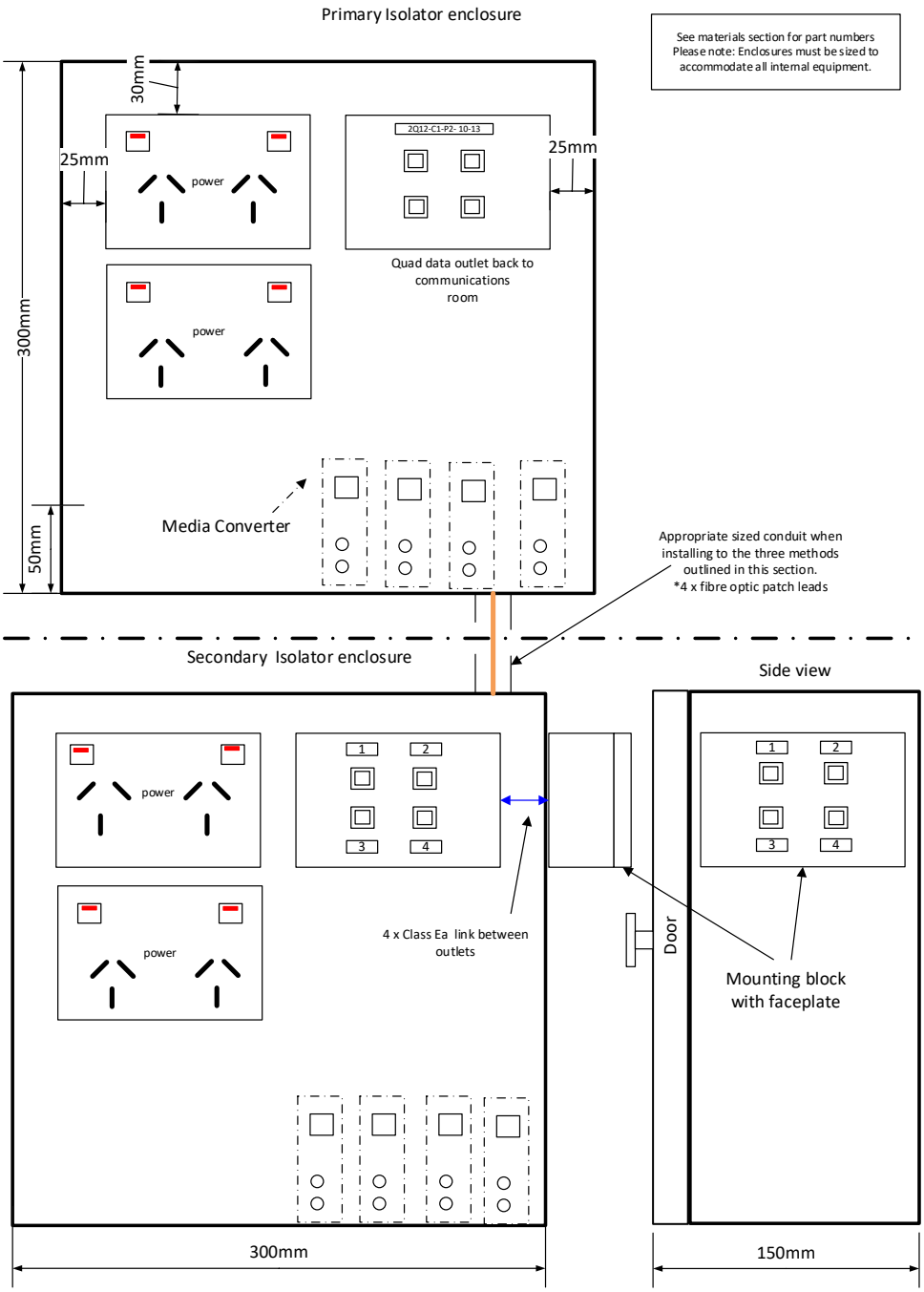
Example 1

Method 3
Same wall or room installation.
Minimum of
2000mm apart



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

Example 2



Example 3

Refer to Section 6 for specific materials for optical Isolators. UNSW Facilities to confirm the outlet & power quantities for each project.

6.12. 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 CET's 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.

6.12.1. 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.

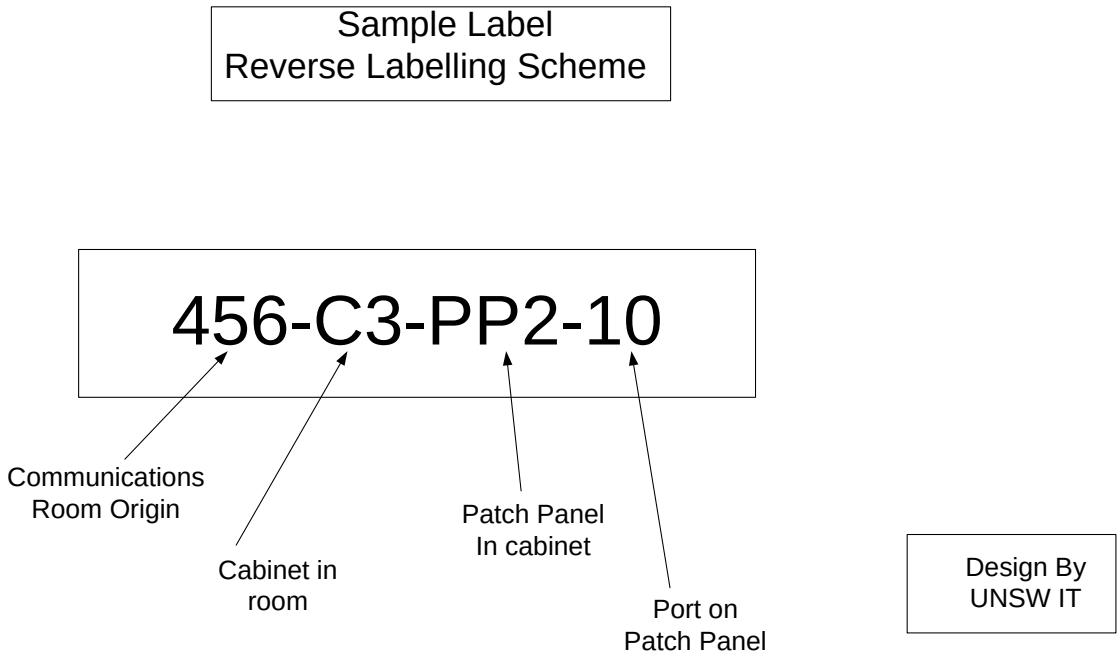
The field end RJ45 ports should be clearly labelled with far end termination details:

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.

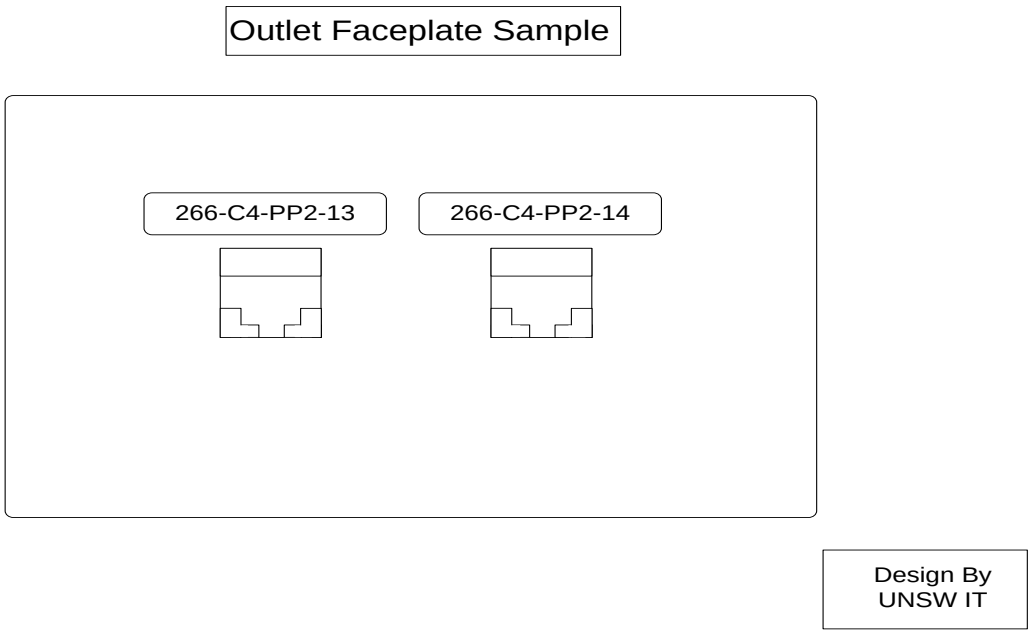


6.12.2.Face Plate Label

All face plate labels will be machine generated using indelible ink ribbons or cartridges. Outlet labels shall be produced by an ITCS approved label maker (Brother, Dymo) or otherwise 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.



6.12.3.Cabinet Label

Individual cabinets within a single room should be labelled “C1” through to “C*n*” 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.

6.12.4. Patch Panel Number Label

Individual patch panels should be labelled sequentially within a cabinet starting at “P1” through to “P*n*” 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.

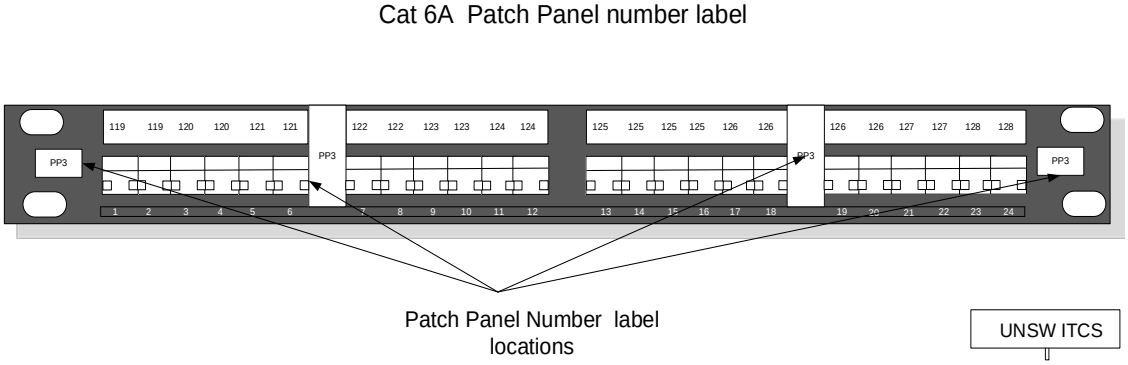


Diagram 3a

6.12.5. 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

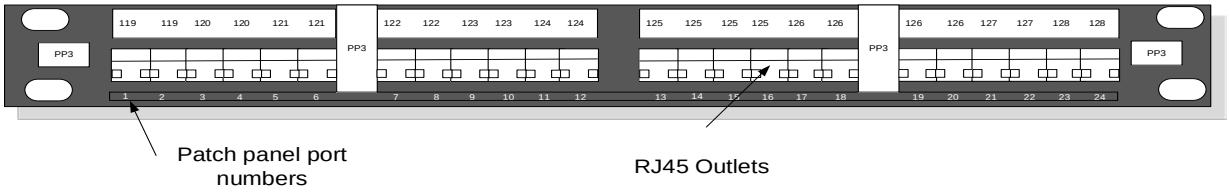


Diagram 3b

6.12.6.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

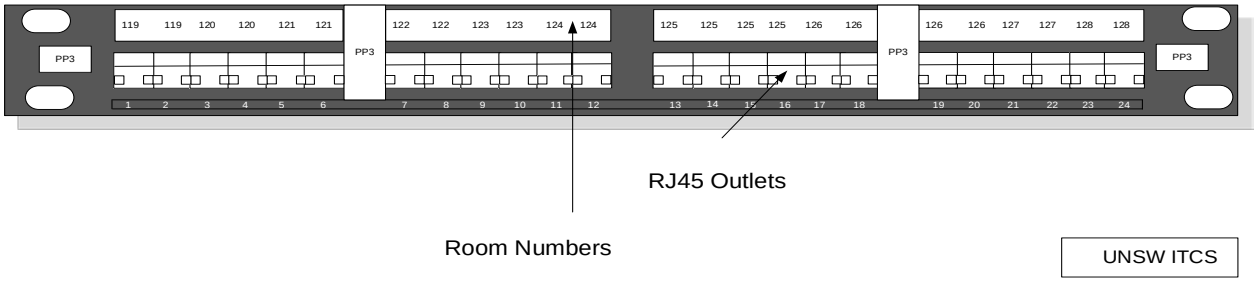


Diagram 3c

6.12.7. 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.

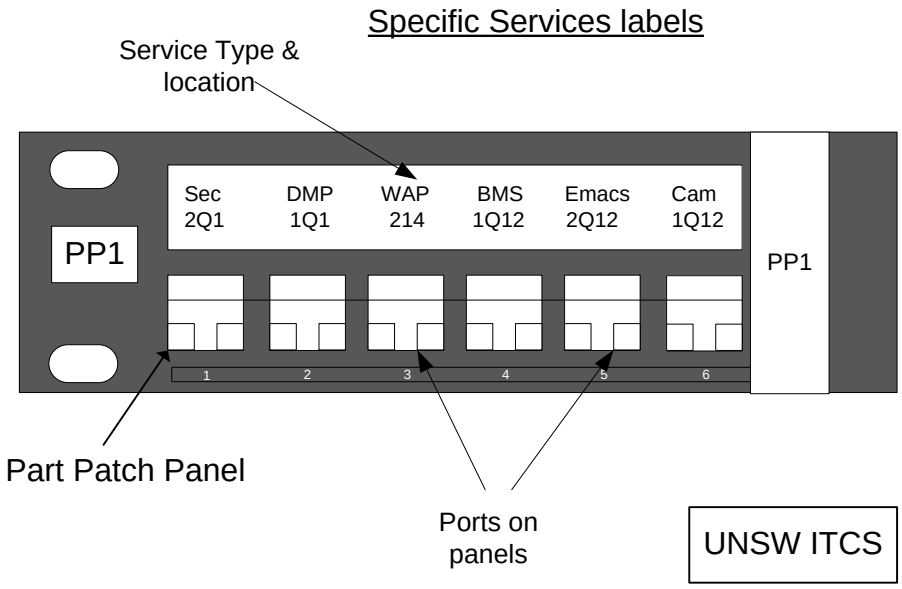


Diagram 3d

6.12.8.Voice Panel Labels

Voice panels are to be labelled as per Diagram 3e below.

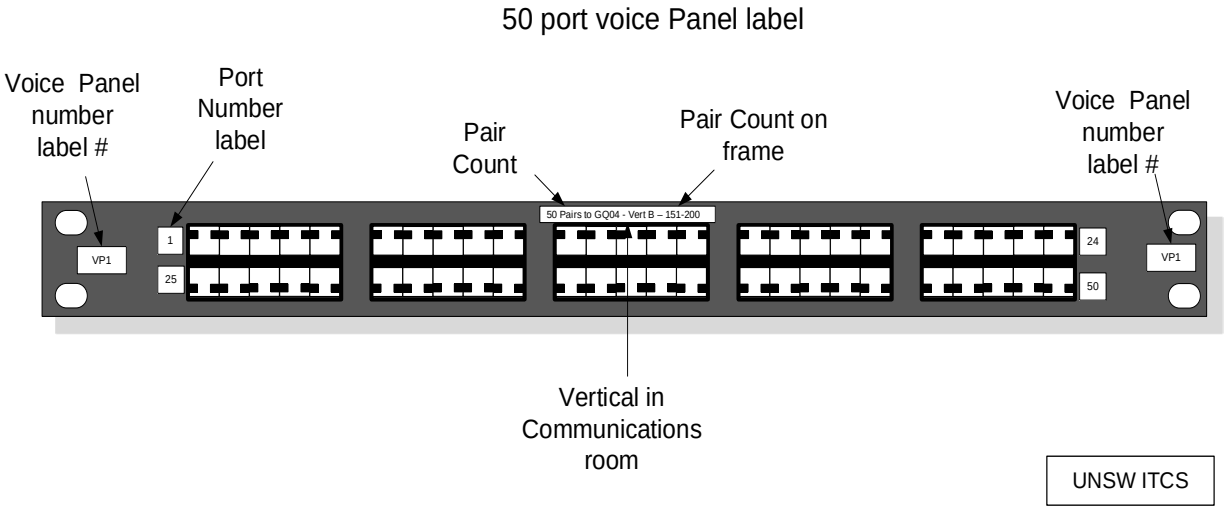


Diagram 3e

6.12.9. 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.

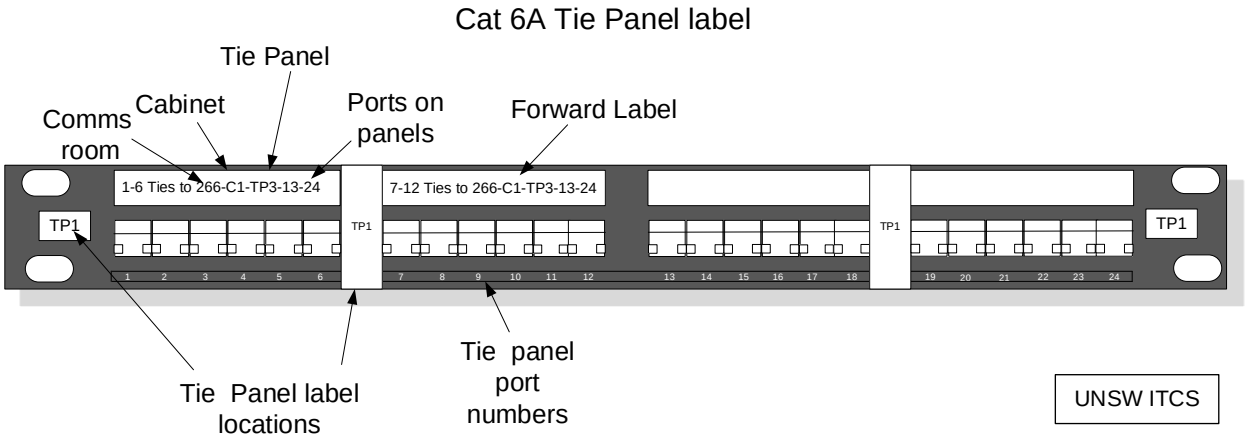


Diagram 4

6.12.10. 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.

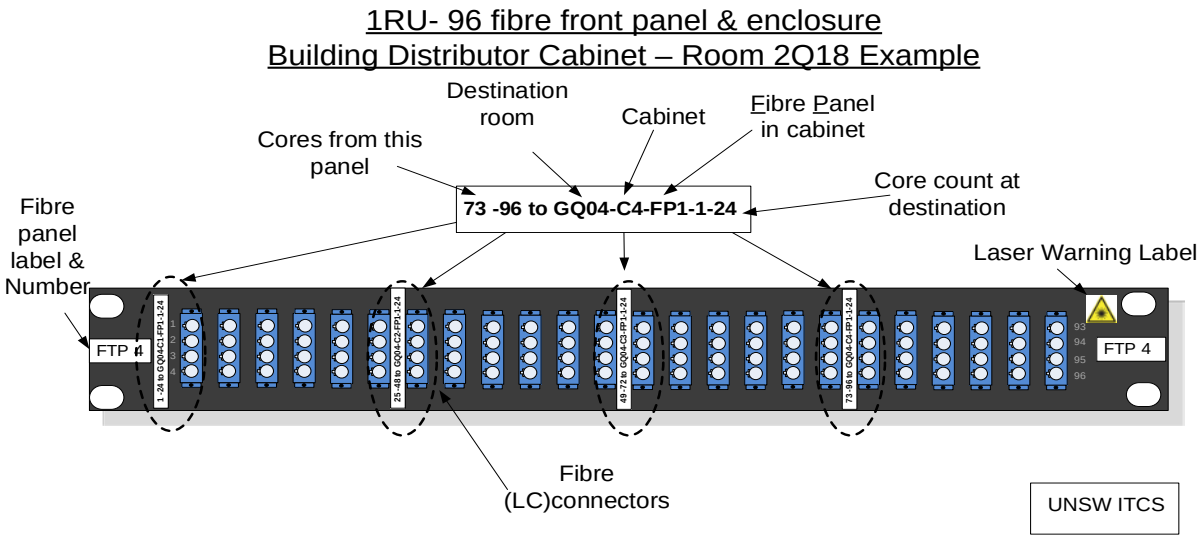


Diagram 5a (Refer to Section 5 for specific part numbers)

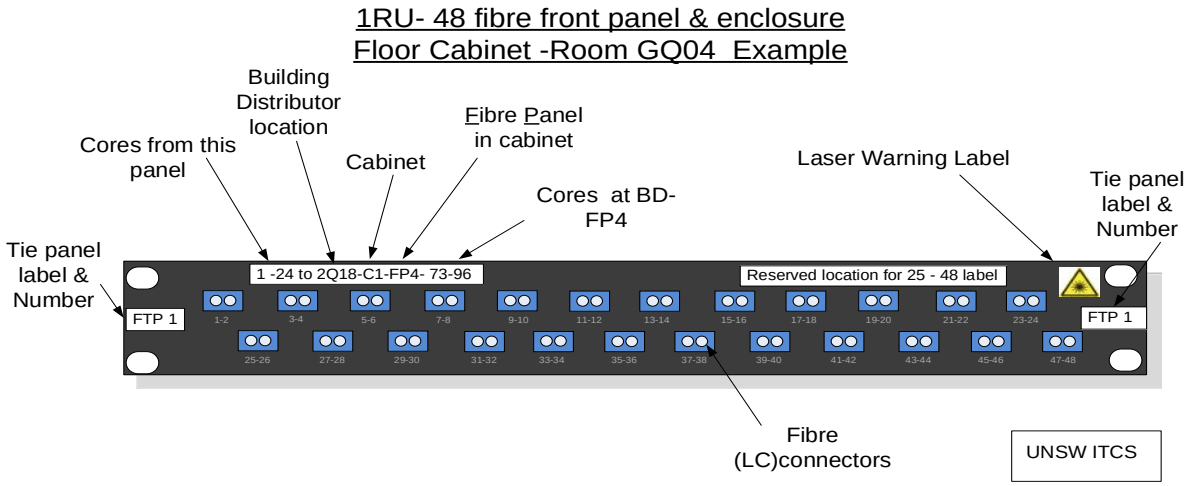


Diagram 5b (Refer to Section 5 for specific part numbers)

Note: The High Bandwidth fibre panel in Cabinet 1, Floor Distributor room may be high density 96c front panel depending on particular requirements.

6.12.11.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.

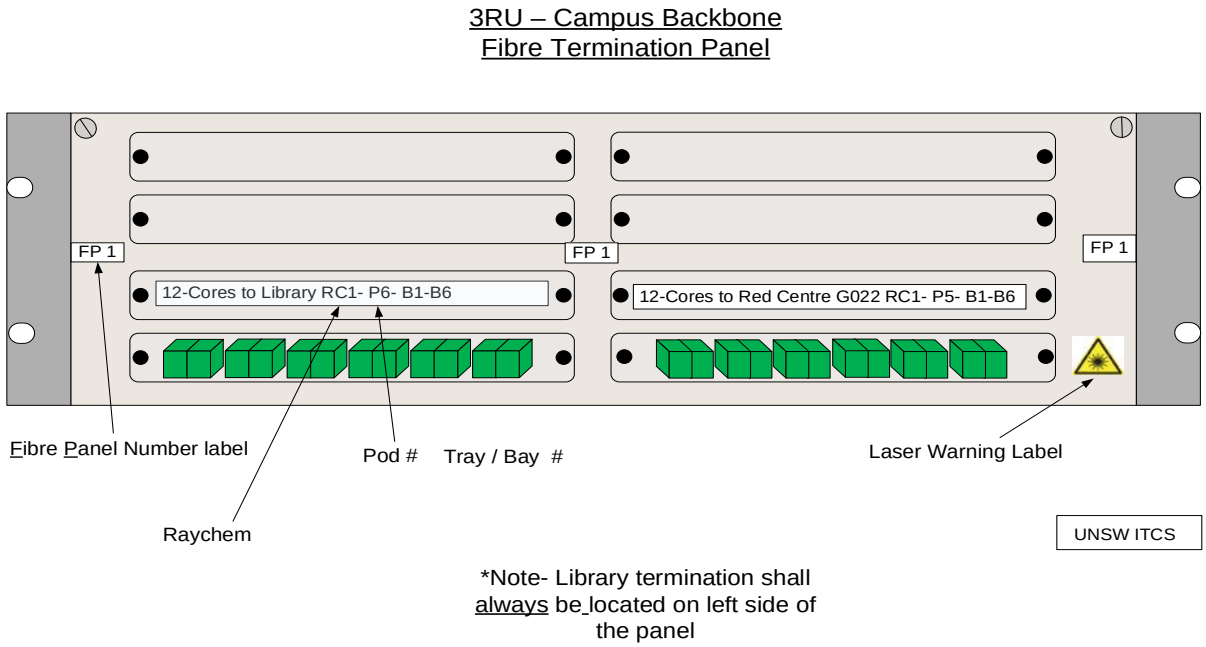


Diagram 5c

6.12.12.Laser Signage

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

1. Warning Label.
2. Explanatory Label.

The Laser Warning Label must be affixed to the terminating fibre panel in each cabinet. Please Diagrams 5b and 5c for the approximate location of the label.

The Explanation Label is to be fixed to the cabinet door. The acceptable locations for affixing this label are:

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

This label shall be made of a Traffolyte material and be legible from 2m. Below is an example of the two labels.

CAUTON- HAZARD

POTENTIAL VISIBLE AND INVISIBLE LASER RADIATION.DO NOT STARE INTO THE BEAM OR VIEW DIRECTLY WITH NON- ATTENUATING OPTICAL INSTRUMENT

LASER Warning Label **Laser Explanation Label**

6.12.13. Voice Frame Labels and Records

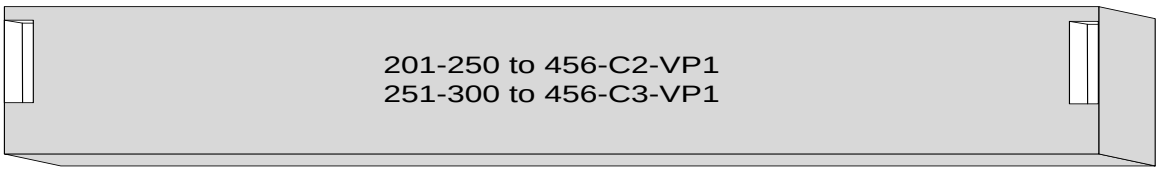
Frame Label

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.

6.12.14.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. See Diagram 6.

IDC Label Module/Holder for Voice frames



UNSW ITCS

Diagram 6

Record books

A3 Perspex covered record sheet holder with 10 sheet inserts is required for the MDF and a standard record 1000pair book for the IDF’s in each Communications Room. Cable tie information is to be entered in the Record Book prior to construction handover.

6.12.15. 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 route and the closest visible point at the cable entry to the building. Usually this plate or label is made of water resistant material attached to the cable physically via a cable tie or similar.

The following information shall be clearly printed on the label. See 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”

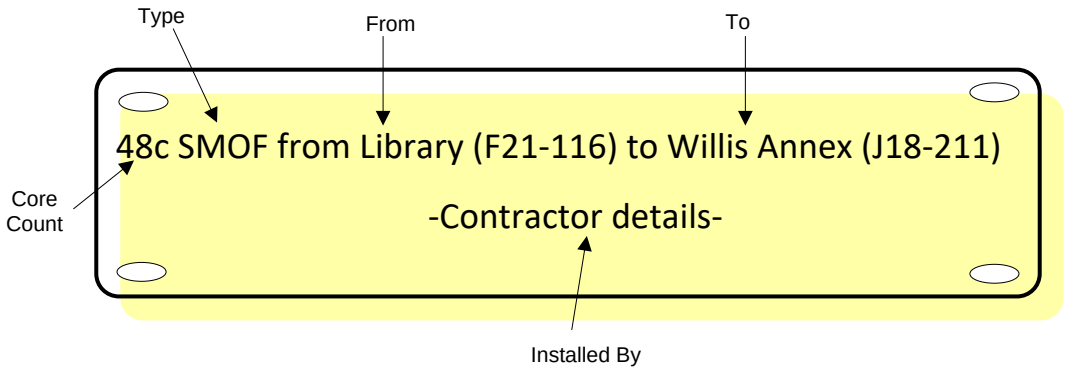


Diagram 7

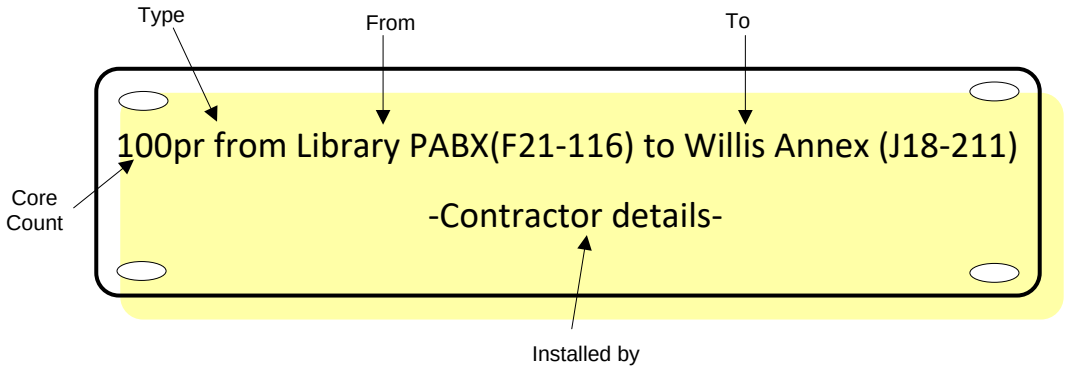


Diagram 8

6.13. 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 or AS/NZS 3080 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.

6.13.1. Copper Testers Accepted by UNSW

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

1. Fluke DTX-5000
2. Fluke DTX-1800

The contractor is responsible to input the correct NVP (Nominal Velocity of Propagation) for Class Ea installation testing. All test report documentation shall be provided in both “PDF” and “.flw” format. Diagram 9 is a sample of an individual test result in PDF format.

ITCS reserves the right to carry out cable tests subsequent to supply of the report below. Any anomalies between results must be explained and/or rectified to the satisfaction of ITCS.

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

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%

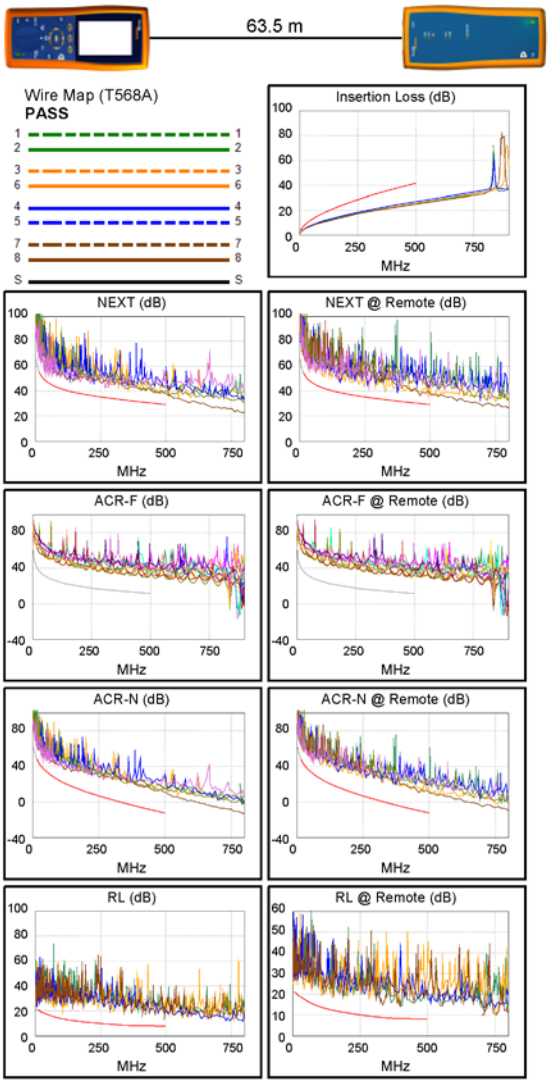
Test Summary: PASS
Model: DTX-1800
Main S/N: 9758179
Remote S/N: 9758180
Main Adapter: DTX-PLA002
Remote Adapter: DTX-PLA002

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

	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	100BASE-T4
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	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

6.13.2. Optical Fibre Testing

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

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. A 3-Test Cord is also acceptable. For Optical Fibre testing, adhere to AS/NZS IEC 14763.3. The cable will be tested to 1310nm and 1550nm Wave lengths.

All fibre test results shall be certified as per the vendor's certification guidelines.

6.13.3. 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.

6.14. Inspections, Defects and Completion

6.14.1. 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 fitout and cabling installation before walls are sheeted and ceilings installed. As a minimum, ITCS and are to 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/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 when all as-built drawings, STP cabling system test results/certification records, communications room final fitout and cleaning, external works or any other works covered by the Communications Specification are complete and defects have been rectified.

6.14.2. Defects

ITCS will submit Inspection Reports including defects to the Project following site inspections. The Contractor/Project will carry out defects' rectification works within seven (7 days) of notification or as outlined in contract arrangements. The Project/Contractor is to maintain a register of all reported communications services defects and is to provide a complete copy of the register with updated information to ITCS as the defects are rectified.

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.

6.14.3. Practical Completion/Final Passive Infrastructure Completion

After ITCS is satisfied with all installations and cabling test results, the STP Cabling System shall be handed over to ITCS. All major and outstanding works must be completed before the System can be handed over 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 defects notified during the defects liability period have been made good.

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

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