

Note to the Designer/Architect/Engineer/Installer: These Specifications are basic minimum criteria to be met in preparing the final project specifications for this section, which is the responsibility of the Designer

York University Building Standards

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1.0. GENERAL

- .1 York University requires Wi-Fi infrastructure design services to determine optimum placement of Wi-Fi Access Points (APs) and antennae to accommodate the daily needs of its students, faculty, researchers and staff. The University wishes to deliver no less than a defined minimum standard of Wi-Fi services to all students, particularly in high density areas, which may accumulate upwards of 500 people at a time.
- .2 The placement of APs must consider the risk of performance— and the impacts to stationary clients (e.g. in class room/lecture hall)— posed by drive-by associations due to active clients passing by or congregating outside of classroom/lecture halls.
- .3 Travel and parking expenses are the responsibility of the contractor.
- .4 Any questions about ambiguities in this document should be directed to the Manager, UIT Network Development.

2.0. Wi-Fi Design Objectives

- .1 The Wi-Fi infrastructure must be capable of accepting associations from all active client devices concurrently, assuming all spaces in the building are occupied to the maximum safe-occupancy limit.
- .2 Must be capable of supporting mass concurrent roaming of client associations between APs (such as during change-over times between classes).
- .3 The design objective is to ensure optimal coverage and performance of the 5GHz band.
- .4 Where the design specifies APs with built-in antennae, it is York University's preference to have such APs mounted such that they are parallel to the floor.
- .5 Due to the frequent presence of low-altitude commercial air traffic over the Keele campus, DFS channel allocation in the 5GHz band must be validated and will need to be approved by the Manager, UIT Network Development.

- .6 The placement of APs must provide a minimum of -67 dBm signal strength and minimum 25dB SNR in the 5GHz band throughout the targeted coverage areas.
- .7 It is necessary to plan for service coverage in those portions of mechanical spaces where building automation equipment is installed. Minimum acceptable 5GHz signal strength in the vicinity of building automation systems is -73 dBm. This is an exception to -67 dBm objective for public spaces.
- .8 Minimum acceptable levels of concurrent per-client device downstream performance are as follows:

2.4 GHz band	5 GHz band
1 Mbps	2 Mbps

- .9 The design for Wi-Fi network service is not required to include the following areas:
- Elevator Interior
 - Enclosed stairwells
 - Washrooms
 - Spaces exterior to the building envelope unless otherwise indicated in writing

2.1. Design Assumptions

- .1 Wi-Fi APs are capable of supporting 802.11a/g/n/ac.
- .2 At minimum, each person will possess two concurrent Wi-Fi client devices. Each person has a Wi-Fi enabled smartphone and a laptop or a tablet device (even distribution).
- .3 At least 50% of smartphones and 50% of laptops and tablets are capable of operating in the 5 GHz band (5 GHz capability rate is expected to increase year-over-year).
- .4 At least 90% of Wi-Fi client devices support 802.11n.
- .5 No Wi-Fi client devices require support of 802.11b. 802.11b will be disabled at the AP.
- .6 Minimum data rate and default data rate are as follows:

Band	Minimum Data Rate	Default Data Rate
2.4 GHz	24 Mbps	36 Mbps
5 GHz	18 Mbps	36 Mbps

- .7 1000Base-T network access with 802.3at for all AP mounting locations.
- .8 Limited support (access restricted by per-client authorization) of Voice over WLAN (VoWLAN) is a future requirement.
- .9 VoWLAN features should be disabled during the initial deployment.
- .10 The infrastructure design must support the following SSIDs:

SSID Name	Auth Type	Encryption	Band
AirYorkPLUS	802.1x	WPA2	2.4GHz and 5GHz
eduroam	802.1x	WPA2	2.4GHz and 5GHz
AirYorkGUEST	Open	None	2.4GHz and 5GHz
WiFi-Info	Open	None	2.4GHz and 5GHz

2.2. Wireless Access Point Location Specifications

- .1 In this section, any reference to antennae also applies to an AP with internal antennae.
- .2 **One CAT 6A** cable shall be provided to each AP location.
- .3 Cable length shall not exceed 90 meters.
- .4 All APs will be mounted according to the specifications defined by UIT Network Development in this document.
- .5 All antennae will be mounted below ceiling tiles. No antennae should be mounted above ceiling tiles nor should they be enclosed within a ceiling.
- .6 Antennae will not be mounted within any cable trays or duct work.
- .7 Antennae will not be encased within ceilings or walls unless approved by the Manager, UIT Network Development.
- .8 Unless otherwise specified by the Wi-Fi designer, antennae should be placed such that their radiation pattern is in close proximity to or

obstructed by structural components nor by building mechanical systems (cabling, ductwork, plumbing, etc.)

- .9 APs will be identified on drawings using the symbols described by drawing **UIT-ICT-02** "WiFi Symbols".
- .10 Where the design does not include sensor capable APs, e.g. Cisco Clean Air, the design should ensure spectrum sensors are included at a minimum spacing of 40000 mm per floor.

2.3. Wireless Pre-Survey

- .1 For new buildings, design plans will be provided in Revit BIM format.
- .2 Building structural plans, floor plans and reflected ceiling plans will be provided in AutoCAD .DWG format as derived from the Revit BIM model.
- .3 Per-building, per-floor and per-room occupancy and type-of-usage indication will be provided for all spaces.
- .4 UIT Network Development will conduct a guided walk-through of each building (or architectural and structural drawings) introducing the Wi-Fi design team to the building.
- .5 Project Manager will facilitate physical access to the building as may be required by Wi-Fi design team to conduct on-site surveys.
- .6 Project Manager will allow 30 days to schedule and complete the Wi-Fi survey and to document AP placement requirements.

2.4. Wireless Design

- .1 Design (sub)contractor to provide UIT Network Development with names and contact information for individuals who will act as the design team.
- .2 Design (sub)contractor to provide 3 references for prior Wi-Fi designs by the named design team in comparable buildings. Selection of (sub)contractor must be approved by UIT prior to commencement of work.
- .3 All transportation, equipment, software and design expertise required to fulfill the deliverables will be provided by the design contractor.
- .4 The design contractor will provide a marked-up floor plan in AutoCAD .DWG format showing:
 - a. Location and unique identifier per AP.

- b. Location and unique identifier per antenna mount, if external to AP.
 - c. Location and unique identifier per Spectrum Analysis sensor, when not integrated with AP.
- .5 The design contractor will provide type and orientation per AP and/or antenna mount ID.
 - .6 Per-building bill of materials in Microsoft Excel format showing model numbers and quantities for each access point, equipment antennae, spectrum analysis sensor, and mounting hardware.
 - .7 Recommended configuration templates for controllers and APs including per-radio channel assignment.
 - .8 Softcopy of predictive model of per-floor signal coverage (in Ekahau Site Survey format).
 - .9 The design shall reasonably account for the influence of structural materials and other local conditions while meeting the design objectives determining the feasibility of AP placements. (e.g. no APs in the middle of projection walls, no APs in operationally inaccessible locations, no APs on designated/identified decorative surfaces).
 - .10 A rough guideline for design is one AP installed per 25 to 30 occupants.

2.5. Wireless Post Install Survey

This section to be developed. For post-install survey procedures please consult Manager, Network Development.

3.0. Interior Installations

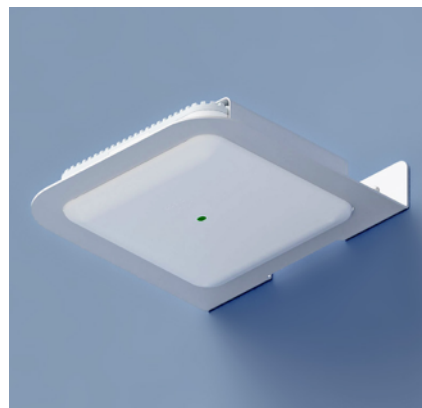
- .1 APs will be installed no higher than 6100 mm.
 - .2 Patch cables shall be routed such that they are not visible from below the access point.
 - .3 Where possible, ceiling mounted APs shall be installed at the intersection of ceiling T-rails, such that the ceiling grid clip straddles the T-rail intersection.
 - .4 Installed surface boxes must use reinforced mounting points.
 - .5 Surface mounted APs and cables shall be routed to location via surface mounted raceway and side entry double gang box.
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- .6 In the case of structural ceilings where a concealed 27 mm conduit is used, a double-gang deep masonry back box (MDV-2) or double-gang deep back box and mud ring shall be installed.

3.1. Internal Antenna APs

- .1 Should be installed at an optimal height between 3000 mm to 4200 mm.
- .2 Should be installed at or below the level of the lighting layer, with no visible obstructions between the antenna and the location of Wi-Fi client devices.
- .3 Should be mounted parallel to floor on ceiling, or wall mount using angle bracket.
- .4 If wall mounting is unavoidable, the angle of AP mounting brackets must be supplied.
- .5 Wall-mounted locations will use a single-gang back box.

Examples of acceptable AP installations for Internal Antenna APs



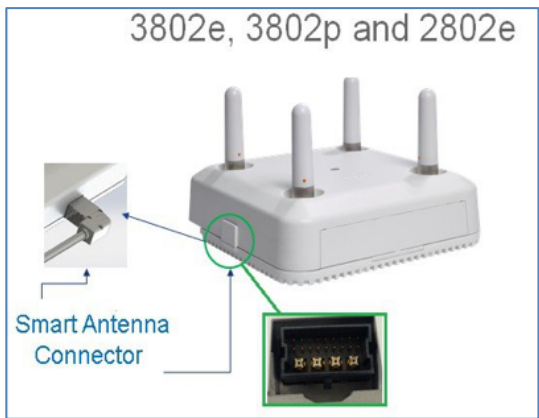
3.2. Wall Plate APs

- .1 Should be mounted flush against the electrical box that delivers the network access cable to the AP.
- .2 If there is no electrical box, then AP should be mounted flush to with no less than 75 mm clearance between bottom of AP and desk height.
- .3 Must be mounted a minimum of 76 mm above desk height.

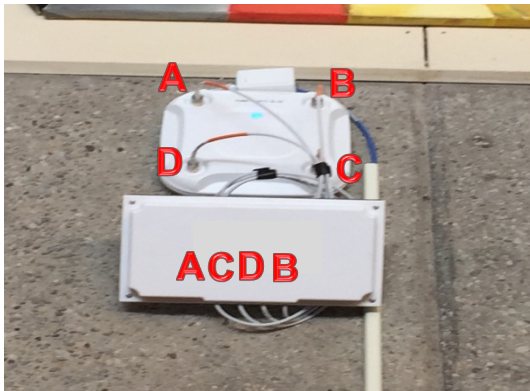


3.3. External Antenna APs (Cisco AP3700e/AP3700p/AP2800e/AP3800e)

- .1 External AP Antennas should be mounted precisely as specified by the WLAN design document.
- .2 There should be no visible obstructions in line of sight from antenna to location of Wi-Fi client device.
- .3 Antenna should be at an optimal height between 3600 mm and 6000 mm.
- .4 Direction of the antenna (azimuth angle, elevation angle) must be as indicated by the WLAN design.
- .5 AP should be mounted close enough to the antenna for the cables to reach the antenna, but in such a manner that the cables are away from the antenna's line of sight and the cables should be connected as shown in the diagram below (yellow stickers to be removed).
- .6 The APs themselves are plenum rated and may be installed above ceilings.
- .7 When connecting two ANT2566 to a single AP2800e, you must connect the second antenna via a Smart Antenna connector cable (Cisco part AIR-CAB002-DART-R=).



- .8 For AP2800e, both the cables and antenna connectors are labelled A–D and should be connected to their respective match.
- .9 For the AP3700e, the cables should be connected as shown in the diagram below. Note: yellow stickers should be removed.



4.0. Exterior Installations

4.1. Street Level Pole Mount

- .1 AC power and optical fiber to the pole shall be provided if the distance between the building communications room and the pole-mounted AP exceeds 9000 mm.
- .2 APs shall be mounted to poles according to the design of the pole, within a 3000 to 7500 mm range, with ideal mounting height at 4500 mm.
- .3 Cable terminations shall be enclosed in an outdoor NEMA Type 4 or similar enclosure.

4.2. Exterior Building Wall Mount

- .1 Provisions shall be made in the building design for the attachment of a metal plate to which outdoor AP mounting brackets can be affixed.
- .2 APs shall be mounted at a height of between 3000 mm to 7500 mm with ideal mounting height at 4500 mm.

4.3. Roof Mounting

- .1 Roof mounts shall be considered if the building height is no greater than 10500 mm.
- .2 Provide one 27 mm conduit stub up/out in proximity of the indicated rooftop AP location.
- .3 The conduit stub shall be capable of preventing rodent ingress.
- .4 Rooftop masts are to be parapet mounted at the building's edge to minimize the radio shadow at the base of the building.

5.0. PRODUCTS

- .1 Internal-antennal wireless AP is Cisco AIR-AP2802I-A-K9 or Cisco AIR-AP3802I-A-K9.
 - .2 External-antenna wireless AP is Cisco AIR-AP2802e-A-K9 or Cisco AIR-AP3802e-A-K9 with either external directional antenna Cisco AIR-ANT2566-P4W-R or Cisco AIR-ANT2566-D4M-R.
 - .3 Sensor AP is Cisco AIR-AP2802I-A-K9 or Cisco AIR-AP3802I-A-K9.
 - .4 Wall-plate wireless AP is Cisco AIR-AP1815W-A-K9.
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- .5 Angle bracket for the wall-mounting of AIR-AP2802I or AIR-AP3802I is Oberon 1006-CCOAP3800.
- .6 Universal mount (interior placements) for Cisco AIR-ANT2566-P4W-R patch-antennae is TerraWave TW-ART-MOUNTT.
- .7 Outdoor placement of APs may require protective enclosures. Part number(s) and quantity to be recommended as required by designer. Final approval of part number(s) is subject to review by UIT Network Development.
- .8 Network designer may substitute other products subject to prior written approval of the Manager, UIT Network Development.

6.0. Drawings and documentation

- .1 All as-built drawings will be received with final cable locations and numbering per **UIT-ICT** standards in DWG. format.
- .2 Predictive design model will be delivered using the latest version of Ekahau Site Survey.
- .3 All drawings will be in AutoCAD DWG format version 2014.

7.0. EXECUTION

- .1 Pathways will be installed with a minimum of 7.6 centimeters of clear vertical space above the ceiling tiles to ensure accessibility and adequate clearance for pulling additional cables.
- .2 Distance between where an AP is marked on the survey and where it is physically installed should not exceed 1 meter.
- .3 UIT Network Operations must label all APs prior to installation.
- .4 Installer must take note of AP labels, and install each AP only in its designed location (e.g. AP-2-15 must be installed on floor 2, location 15 as indicated on design drawings.)
- .5 Installer may not, under any circumstances, remove or alter AP identification label on any AP. Identification labels are specifically assigned and recorded to the serial number of the AP.

- .6 In all cases of uncertainty regarding precise location or orientation of individual AP and/or antenna, installer must seek consultation and approval of UIT Network Development prior to completing installation.
- .7 All equipment, materials and installation shall all conform to the latest version of applicable Codes, Standards and regulations of all authorities with jurisdiction in the province of Ontario.
- .8 All Contractors will comply with ANSIW/TIA Telecommunications Industry Standards.
- .9 All Contractors will comply with CEC –Canadian Electrical Code Standards.
- .10 All Contractors will follow York University Asbestos policy if encountered during a building renovation. Follow link below for details:
<http://www.yorku.ca/csbo/maintenance/asbestos.htm>.

8.0. References

- .1 For further reference, please see the cisco AP installation guide:
www.cisco.com/c/en/us/td/docs/wireless/technology/apdeploy/8-0/Cisco_Aironet_3700AP.html
and
www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-3/b_cisco_aironet_series_2800_3800_access_point_deployment_guide/b_cisco_aironet_series_2800_3800_access_point_deployment_guide_chapter_010.html

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