NOTICE TO BIDDERS

SMALL BUSINESS RESERVE PROCUREMENT

This is a Small Business Reserve Procurement for which award will be limited to Certified Small Business vendors. Only businesses that meet the statutory requirements set forth in State Finance and Procurement Article, §§ 14-501 - 14-505, Annotated Code of Maryland, and who are registered with the Department of General Services Small Business Reserve Program are eligible for award of a contract.

For the purposes of a Small Business Reserve Procurement, a small business is a business, other than a broker, that meets the following criteria:

- The business is independently owned and operated;
- The business is not a subsidiary of another business;
- The business is not dominant in its field of operation;
- The wholesale operations of the business did not employ more than 50 persons, and the gross sales of the business did not exceed an average of $4,000,000 in its most recently completed 3 fiscal years;*
- The retail operations of the business did not employ more than 25 persons, and the gross sales of the business did not exceed an average of $3,000,000 in its most recently completed 3 fiscal years;*
- The manufacturing operations of the business did not employ more than 100 persons, and the gross sales of the business did not exceed an average of $2,000,000 in its most recently completed 3 fiscal years;*
- The service operations of the business did not employ more than 100 persons, and the gross sales of the business did not exceed an average of $10,000,000 in its most recently completed 3 fiscal years;* and
- The construction operations of the business did not employ more than 50 persons, and the gross sales of the business did not exceed an average of $7,000,000 in its most recently completed 3 fiscal years.*
- The architectural and engineering services of the business did not employ more than 100 persons and the gross sales of the business did not exceed an average of $4,500,000 in its most recently completed 3 fiscal years.

* If a business has not existed for three years, the gross sales average shall be the average for each year or part of a year during which the business has been in existence.

Further information on the certification/registration process is available at e-Maryland Marketplace.
COMPETITIVE SIMPLIFIED PROCUREMENT
5/7/19

PROJECT TITLE: CFA & ES Wireless Upgrade

DESCRIPTION: Towson University is seeking a contractor to relocate, and add wireless access points in two university buildings.

SCHEDULE: The work must begin not earlier than Wednesday, May 29, 2019 and be completed not later than Wednesday July 3, 2019.

PRE-BID/PROPOSAL CONFERENCE: 5/10/19 @ 10:00 AM, at the Campus Office Location in the Administration Building, Room 408, 7720 York Rd., Towson, MD 21204. If you wish to request an ADA accommodation, please telephone (410) 704-2171. Site visit to immediately follow pre-bid conference.

SECOND SITE VISIT: 5/15/19 @ 10:00 AM, Meet in the first floor lobby of the Administration Building.
(One Site Visit is Mandatory)

DEADLINE FOR QUESTIONS: 5/17/19 @ 4:30 PM

BID DUE NO LATER THAN: 5/24/19 @ 2:00 PM. Late bids, late requests for modification, or requests for withdrawal will not be considered.

DIRECT QUESTIONS TO: Wendy Childs, Procurement Officer Representative, via email: WChilds@towson.edu or by Phone: (410) 704-3486.

PROCUREMENT METHOD: This solicitation will be conducted in accordance with the University System of Maryland’s (USM) Procurement Policies and Procedures, Competitive Simplified Procurement.

BASIS FOR AWARD: Award will be made to the responsible bidder who submits the responsive bid determined to be most advantageous to the University.

PARKING: All vehicles parked on Towson University property must strictly observe University parking regulations. Each vehicle parked on campus between 6 am and 8 pm, Monday through Thursday, and from 6 am to 3 pm on Fridays, must display a valid University permit unless parked at a paid meter. Parking on sidewalks or unpaved areas is prohibited at all times. All fines for parking or other vehicle violations are the responsibility of the Contractor. This applies to vendors, salespersons, company vehicles, and Contractor employees’ personal vehicles. Long- and short-term permits are available, at designated rates, for vendors with contracts that require them to park regularly on the campus; see the parking website at https://www.towson.edu/parking/visitors/ for permit rates and information to support preparation of Bid/Price Proposal. Parking Transportation phone: (410) 704-7275.

NOTE: INCLUDE PARKING FEES IN BID/PRICE PROPOSAL.

SMOKING: Smoking, defined as the burning of tobacco or any other material in any type of smoking equipment, including but not restricted to cigarettes, cigars or pipes, is prohibited on all property owned, leased or operated by the University. This consists of all buildings, including residence halls, leased
restaurants and lodging facilities; all grounds, including exterior open spaces, parking lots and garages, on-campus sidewalks, streets, driveways, stadiums, recreational spaces and practice facilities; and in all University-owned or leased vehicles. The policy applies to all individuals on the University campus, including faculty, staff, students, parents, vendors and visitors. Contractor and its employees and subcontractors who violate the policy may be denied access to the University campus.

INSURANCE: Upon award, successful Bidder must submit proof of automobile bodily injury liability insurance with limits of not less than $1,000,000 per person and $2,000,000 per accident, and property damage liability insurance with a limit of not less than $2,000,000 for each accident. Proof of workers compensation and commercial general liability insurance must also be provided. Information must be on ACORD certificate or company letterhead bearing signature of a company official, and include the carrier’s and agent’s names, policy number, effective date, and coverage amount, naming Towson University as additional insured.

RESERVATIONS: The University reserves the right to reject any or all bids, award the contract in whole or in part, or to make no award, as its best interests may require.

MINORITY BUSINESSES ARE ENCOURAGED TO RESPOND

INCLUDED IN BID PACKAGE:
• Scope of Work
• Attachment I - IT Infrastructure Standards
• Attachment II - CFA Floor Plans
• Attachment III - ES Floor Plans
• Attachment IV – Manufacturer Wireless AP Product Overview
• Attachment V – Manufacturer Wireless AP Mounting Instructions
• Bid/Price Proposal Form
• Exhibit F – Company Profile
• Exhibit G – Firm Experience
• Exhibit K – Addenda Acknowledgement
• General Terms/Conditions for Simplified Acquisitions

BID SUBMITTALS: The following items should be submitted:
• Bid/Price Proposal Form
• Exhibit F
• Exhibit G (Duplicate as necessary)
• Exhibit K (if applicable)

Prices quoted are valid for 90 days unless otherwise noted.

SUBMIT BIDS VIA FAX, REGULAR MAIL, E-MAIL OR HAND DELIVER:
• Fax: 410-704-8233, Attention to Victoria Nellis
• Hand deliver, or use professional courier (preferred) to the *Campus Office Location, OR

• Mail to the **Issuing Office. The Issuing Office is a central campus location. Mail received at this location is internally sorted then delivered to the intended campus departments; therefore, allow plenty of extra time.

Indicate on the outside of the envelope the solicitation/project number, bid due date, and bidder’s name and address.
Electronic Submittal: Submit bid via email to bids@towson.edu as an attachment by the bid due date and time. The solicitation number, title and your organization’s name must appear in subject line. Note: This e-mail address is for the receipt and storage of authorized bids ONLY. It is not monitored for any other type of correspondence. All other correspondence must be directed to the appropriate procurement representative per the instructions contained in this document.
SCOPE OF WORK

A. SUMMARY STATEMENT
Towson University (TU) is upgrading its wireless network in two (2) buildings: Center for the Arts (CFA) and Enrollment Services (ES). The upgrade includes adding new University-provided wireless access points and drops, and if indicated on site plans, relocating existing data drops to their new location and installing the new University-provided wireless access points. The University is seeking a contractor to:

1. Install, label, and test new category 6A cable from IT hub rooms to locations indicated on attached site plans.
2. Mount new University-provided wireless access points.
3. Move existing data drops as indicated on attached site plans and install a new University-provided wireless access point.

B. MATERIALS
1. The University will provide all wireless access points.
2. The Contractor must provide all materials required for this work, including but not limited to, cable, patch panels, jacks, RJ45s, etc.
3. The Contractor must provide all equipment necessary to complete the work, including but not limited to, ladders, crimpers, wire strippers, testers, labelers, etc.

C. EXECUTION
The Contractor shall ensure all installations adhere to Towson University IT Infrastructure Standards, Attachment I.

1. For each new drop shown on the site plans, the contractor must:
   a. Install one category 6A cable from the nearest IT hub room to each of the wireless access point locations shown on the site plans, leaving a 15’ service loop at the wireless access point location.
   b. Terminate the cable in the hub room with a yellow Ortronics jack and install it in a contractor-provided patch panel.
   c. Terminate the cable with an RJ45 at the wireless access point location.
   d. Label the cable on both ends.
   e. Test the cable end-to-end.
   f. Mount a new University-provided wireless access point.
   g. Connect the cable to the wireless access point.

2. For each existing wireless access point the contractor must:
   a. Disconnect the data cable from the wireless access point.
   b. Unmount the wireless access point and return it to the University.
   c. If indicated on the site plans, move the data drop to its new location.
   d. Mount the new University-provided wireless access point.
   e. Connect the cable to the new wireless access point.

3. Labeling:
a. For each patch panel the contractor installs, the contractor must affix a label to the left side of the panel with the panel’s identifier.
b. Patch panel identifiers are single capital letters.
c. The panel identifier for the top-most panel is A, the next one down is B, and so on, until the contractor reaches the bottom of the rack.
d. If there is more than one rack, patch panel identifiers continue in sequence from top to bottom and then from the left-most rack to the right-most rack. For example, if the first rack has panels A-D, the top-most panel in the rack to the right would be E.
e. Labels must be machine-made, not hand-written.
f. Cable identifiers are of the form: A-BC, where:
   1) A is the hub room identifier (1A, 2A, 3C, etc.), as shown on the attached floor plans.
   2) B is the patch panel identifier (A, B, C, etc.)
   3) C is the zero padded port number as shown on the patch panel (01, 02, 12, 13, etc.)
   4) For example, 2A-C03 is a cable terminated in hub room 2A on port 3 of panel C.
g. The contractor must label each new cable within 6 inches of:
   1) Where it attaches to the patch panel.
   2) The end-station termination.
h. The contractor must label each patch panel port with the port number 01, 02, 03, etc., if the patch panel does not already have the patch panel ports labelled.

4. Testing
a. The contractor must test, certify, and document each newly installed cable for end-to-end compliance with the category 6A standard and furnish the documentation prior to the completion of the project.

5. As-Built Documentation
a. The contractor must provide an as-built spreadsheet that provides a map of each cable identifier and the location of end-station.
b. A short description referencing the nearest room or notable physical feature is acceptable for the end station location.

6. Miscellaneous
a. The University warrants that the data drops for wireless access points that the contractor must move can be moved to their new location.
b. The contractor will not test or relabel existing data drops.
c. The University has provided a manufacturer product overview, and mounting instructions for the access points for informational purposes (Attachment IV & V).

D. SCHEDULE & COORDINATION
1. The work must begin not earlier than May 29, 2019, and be completed not later than July 3, 2019. The schedule window is firm and cannot be shifted.
2. Standard work schedules shall be 8AM – 5PM, Monday – Friday, unless otherwise approved by Towson University.

3. The contractor must coordinate all work with the University’s Office of Technology Services.

4. The Contractor must provide the University with not less than five (5) business days’ notice to access each building.

5. Once the University receives notice from the Contractor that work will begin in a building, the University will inform the building occupants and work with the building occupants and the Contractor to schedule access to specific rooms, if there are any specific rooms that have scheduled activities.

6. Penetrations through walls must be coordinated with TU’s Facilities Management department.

E. SITE PLANS

Floor plans (Attachment II and III) indicate AP locations and cable pathways, and shall be read as follows:

1. In the drawings for the Center for the Arts:
   a. Red dots indicate the location of a drop the contractor must install.
   b. Blue dots indicate the location of an existing drop that the contractor must move.
   c. Yellow highlighted rooms are telecommunications rooms to which new cables must be run.

2. In the Center for the Arts, the IT hub room numbers and identifiers are:
   a. 1002TC (1A)
   b. 1003TC (1B)
   c. 2020TC (2A)
   d. 2036TC (2B)
   e. 2074TC (2C)
   f. 3018TC (3A)
   g. 3040TC (3B)
   h. 3043TC (3C)
   i. 4038TC (4A)

3. In Enrollment Services, the IT hub rooms are:
   a. ES112D (1A)
   b. ES105C (1B)

4. The University is providing the following approximate wireless access point count to help bidders ensure they are interpreting the site plans properly. Please refer to the site plans for actual wireless access point locations:
   a. Center for the Arts
1) There are approximately one hundred fifty two (152) new wireless access point locations.
2) There are approximately sixty two (62) drops to be moved.

b. Enrollment Services
1) There are approximately forty nine (49) new wireless access point locations.
2) There are approximately sixteen (16) drops to be moved.

F. SITE VISIT
1. Prior to submitting its bid, each contractor is required to attend one (1) of the two (2) scheduled site visits to examine the facility and familiarize themselves with the full nature and extent of the work to be done. They shall obtain for themselves all information that may be necessary for the satisfactory performance of the contract work and the cost thereof. It is the sole responsibility of the contractor to fully familiarize themselves with the areas involved and the extent of the services required by visual inspection. Failure to visit the site and become familiar with the conditions and requirements affecting the work will not relieve the successful contractor from the provisions of the contract and from completing the work for the consideration set forth.

2. Shortly after contract award, a pre-construction conference will be scheduled at the jobsite to review schedule, sequence of work, and task specific items.

3. By submitting a bid the contractor acknowledges that he has investigated and satisfied himself as to the conditions affecting the work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, and electric power. Any failure by the contractor to acquaint himself with the available information will not relieve him from responsibility for estimating properly the cost of successfully performing the work. The University shall not be responsible for any conclusions or interpretations made by the contractor of the information made available by the University.

G. QUALIFICATIONS
1. EXHIBIT F, Company Profile. The installing contractor must have at least five (5) years’ experience in the telecommunications industry installing, terminating, and testing UTP.

2. EXHIBIT G, Firm Experience. Duplicate as necessary to furnish references for not less than three (3) comparable projects completed within the past five (5) years, or currently underway.

3. The University reserves the right to require that a contractor demonstrate that it has the skills, equipment, and other resources to satisfactorily perform the nature and magnitude of work necessary to complete the project within the proposed contract schedule.

H. STORAGE OF EQUIPMENT/MATERIALS AND TRASH REMOVAL
1. The contractor is responsible for the storage and security of their equipment and materials.
2. The University may, upon request, provide space for storage. However, the University cannot guarantee the safety of equipment and materials.

3. The contractor is responsible for cleaning up after their work and must dispose of all trash off-site.

I. SAFETY
1. The contractor shall supply, install, and maintain all barriers, protection, warning lights, lighting, and personnel required to segregate the work area(s) from pedestrian or vehicular traffic, as well as to prevent damage to buildings, their occupants, and the surrounding landscaped and paved areas. The Contractor shall observe all applicable OSHA and MOSHA requirements.

2. The contractor must wear identification or shirt with company logos.

J. WARRANTY
The contractor shall provide the University’s standard two-year warranty on labor.

END
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1 OVERVIEW

1.1 Purpose

1.1.1 This document describes Towson University’s IT infrastructure standards for its cable plant and its data, telephone, and television network.

1.1.2 This standard references a set of industry standards to which the University’s IT infrastructure must conform and supplements them with University-specific requirements.

1.1.3 The University provides this document to consultants developing construction documents, bidders bidding on cabling projects, and contractors performing cabling work.

1.1.4 For a consultant developing construction documents, it provides the information required to design an IT infrastructure that is consistent with Towson University’s IT infrastructure standards and to integrate that design into construction documents.

1.1.5 For a bidder bidding on a University cabling project that contains or references this document, it defines acceptable materials, execution requirements, and other information required to develop a bid.

1.1.6 For a contractor executing cabling work, it provides instructions and requirements for performing the work.

1.2 Organization

1.2.1 This document is divided into four parts:

   a) Overview
   b) Design standards
   c) Parts & Materials
   d) Execution

1.2.2 Each part is organized into sections and subsections.

1.2.3 Each provision of the standard has a unique identifier to make them easy to reference.

1.3 Guidance for Consultants

1.3.1 This section contains guidance for consultants developing construction documents.

1.3.2 A consultant must understand this document thoroughly.

1.3.3 The design specifications section provides the high-level information a consultant needs to design the IT infrastructure.

1.3.4 Parts & Materials
1.3.4.1 This document specifies parts and materials by:

a) Performance characteristics.

b) Specific manufacturer and part number.

1.3.4.2 Parts and materials specified by performance characteristics can be any part by any manufacturer that meets or exceeds the specified performance characteristics except for manufacturers or part numbers expressly prohibited by this document.

1.3.4.3 Parts and materials specified by manufacturer and part number are specific parts that must be used.

1.3.5 Telecommunication Rooms

1.3.5.1 This document goes to great length to specify the bare minimum requirements for Telecommunication rooms. Therefore, they must meet the requirements in this document must be met. There is no room for flexibility.

1.3.5.2 The most common problem and source of frustration for all parties during the development of construction documents is improperly located and sized telecommunication rooms.

1.3.5.3 To ensure telecommunication rooms are properly located and sized, the consultant must:

a) Ensure telecommunication room requirements are included in the conceptual design document along with programming for all other parts of the building, with worst-case square footage and specific requirements for their location.

b) Ensure that telecommunication room requirements are included in all submissions of the design development documents, that the telecommunication rooms are clearly shown on drawings, and that their size and location meets requirements.

c) Ensure that telecommunication room requirements are met in all submissions during the construction document development.

1.3.6 Frequently Missed Items

1.3.6.1 Equipment racks, wire management, patch panels, faceplates, and jacks are all specified by manufacturer and part number are frequently missed.

1.3.6.2 The requirement for penetrations through fire rated structures, particularly the cable count threshold for the use of conduit with fire stopping vs EZ-Path fire barriers, is frequently missed.

1.3.6.3 The color-coding for category 6 and 6A UTP is frequently missed.

1.3.6.4 The color-coding and specific part numbers for category 6 and 6A jacks is frequently missed.
1.4 Scope Conflicts

1.4.1 This section pertains to projects where the University provides this document to a bidder as part of a bid package, or references it in a bid package.

1.4.2 Bidders must bring conflicts between the scope of work and this document to the University’s attention for clarification.

1.4.3 If a bidder fails to bring such conflicts to the University for clarification, this document takes precedence unless the scope of work explicitly states it overrides this document.

1.5 Construction Document Conflicts

1.5.1 This section pertains to projects where a design consultant integrates these standards into construction documents used for bid.

1.5.2 The design consultant is solely responsible for integrating these requirements into the construction documents.

1.5.3 The University’s review of construction document submissions in no way relieves the design consultant of his responsibility to integrate these requirements into the construction document.

1.5.4 The design consultant must bring conflicts between this document and the construction documents to the University’s attention for clarification.

1.5.5 If the design consultant fails to bring such conflicts to the University’s attention, this document takes precedence.

1.6 Quality Assurance

1.6.1 The contractor must perform work in accordance with the BISCI Methods Manual.

1.6.2 The contractor must perform work in accordance with the EIA/TIA Building Telecommunications Wiring Standards.

1.6.3 The bidder is responsible for bringing conflicts between this document and the BICSI or EIA/TIA standards to the University for clarification.

1.6.4 If the bidder fails to bring such conflicts to the University for clarification, the more stringent standard applies.

1.7 Submittals

1.7.1 If site conditions prohibit installation as shown on the drawings, the installer must submit the required changes to Towson University for approval prior to installation.

1.7.2 The contractor must submit cut sheets for each part or material required for the project that this document specifies by performance characteristics for the University’s review and approval prior to ordering.

1.7.3 The contractor must submit all installation procedures that deviate from the manufacturer’s installation procedures to the University for review and approval prior to ordering.
1.8 Documents

1.8.1 The contractor must accurately record the location of service entrance conduit, termination backboards, outlet boxes, port locations and labeling, cable raceways and basket trays, pull boxes, and equipment boxes on detailed floor plans.

1.8.2 The contractor must document the cable plant and associated equipment in accordance with the specifications detailed below.

1.8.3 The contractor must provide test results in Microsoft Excel format for all cables installed.

1.9 Applicable Standards

1.9.1 The University has adopted the standards included in this section and has referenced them rather than repeat them in this document.

1.9.2 In the event of a conflict between these standards, or between these standards and this document, the more stringent standard applies.

1.9.3 TIA/EIA Standard 569 – Commercial Building Standard for Telecommunications Pathways and Spaces

1.9.4 TIA/EIA Standard 568B – Commercial Building Telecommunications Wiring Standard

1.9.5 TIA/EIA Standard 606A – Administration Standard for Telecommunications Infrastructure of Commercial Buildings

1.9.6 TIA/EIA Standard 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications

1.9.7 National Electric Code
2 DESIGN STANDARDS

This section describes the standards a design consultant needs to develop an IT infrastructure that is consistent with the University’s IT infrastructure standards and incorporate that design into construction documents suitable for bid.

2.1 Conventions

2.1.1 Throughout this section, the following phrases have the meanings defined here.

2.1.2 The phrase “the consultant must specify” indicates that the consultant must include the information that follows in the construction documents.

2.1.3 The phrase “point of penetration” indicates the point where the outside plant cable emerges into the building, through either an exterior wall or the basement slab, as defined in the NEC.

2.1.4 “Construction documents” refers to all drawings and narrative text a consultant develops for bid.

2.2 Outside Plant Cable

2.2.1 OSP cable consists of single-mode and copper cable.

2.2.2 OSP coaxial cable is not required.

2.2.3 The consultant must consult the Office of Technology Services for the types and counts of OSP cable.

2.2.4 The consultant must specify OSP cable consistent with the performance characteristics for OSP cable provided in the Parts & Materials section of this document.

2.3 Riser Cable

2.3.1 Riser cable consists of single mode fiber optic cable, copper cable, and coaxial cable.

2.3.2 The consultant must specify 24 single mode fiber optic cables from the MDF to each IDF.

2.3.3 The consultant must specify a 25-pair copper cable from the MDF to each IDF.

2.3.4 The consultant must specify one RG6 coaxial cable from the MDF to each IDF.

2.3.5 The consultant must specify riser cable that is consistent with the performance characteristics for riser cable provided in the Parts & Materials section of this document.

2.4 End-Station Cable

2.4.1 End-station cables are Category 6 UTP, Category 6A UTP, and RG11 coaxial cable, that extends from a MDF or IDF to an end-station.
2.4.2 Cable for data must be orange Category 6 UTP. Installers must terminate data cable with an orange Category 6 jack at the end-station and at the patch panel in the TR.

2.4.3 Cable for analog voice must be grey Category 6 UTP. Installers must terminate analog voice cable with a black Category 6 jack at the end-station and on a 110-punch block in the TR.

2.4.4 Cable for wireless access points must be yellow Category 6A UTP. The installer must terminate wireless access point cable with an RJ-45 at the wireless access point location and on a yellow Category 6A jack at the patch panel in the TR. The installer must provide a 15’ service loop at the wireless access point location.

2.4.5 Cable for surveillance cameras must be green Category 6A UTP. The consultant must specify that the installer must terminate surveillance camera cable with an RJ-45 at the surveillance camera location and a green Category 6 jack at the patch panel in the TR. The installer must provide a 15’ service loop at the wireless access point location.

2.4.6 The consultant must specify the performance characteristics for end-station cable and terminators provided in the Parts & Materials section of this document.

2.4.7 A standard communication outlet for an office consists of two data jacks.

2.4.8 Each office space must have exactly one standard communications outlet for each desk. Any deviation from this standard must be approved by the University’s Office of Technology Services.

2.4.9 The consultant must offset Communication outlets on adjoining walls such that they are not exactly back-to-back.

2.5 **Cable Pathways & Supports**

2.5.1 This section describes interior cable pathways and supports.

2.5.2 Cable in all TR’s must be supported by ladder rack.

2.5.3 Cable in all major corridors must be supported by basket tray.

2.5.4 Cable in minor corridors must be supported by j-hooks.

2.5.5 There must be 12 inches of clearance above and to one side of all cable supports.

2.5.6 The consultant must specify cable supports sufficient to satisfy the initial capacity for the project plus a reasonable margin for growth given the potential use of the space it serves.

2.5.7 Installers must not attach cable supports to anything other than the building structure.

2.5.8 Installers must not attach anything to telecommunications cable supports.

Installers must not install anything other than telecommunications cable or low voltage cable specifically approved by the Office of Technology Services in telecommunications cable supports.

2.5.9 Penetrations through fire-rated walls intended to support 8 or fewer cables must use conduit with fire-stopping putty.

2.5.10 Penetrations through fire-rated walls intended to support more than eight cables must
use EZ-Path fire barriers.

2.5.11 Penetrations through non-fire-rated walls must be conduits or sleeves.

2.5.12 Vertical chases outside of a TR must have:
   a) Access panels on each floor.
   b) Plywood on each interior wall.

2.5.13 The consultant must include 4 4-inch sleeved core holes inside each stacked TR’s to create an open vertical chase within the stack of TR’s.

### 2.6 Conduits & Fire Stopping

2.6.1 Conduit sleeves must be four (4) inch trade size minimum with a minimum of three (3) sleeves to connect the TC’s vertically.

2.6.2 Sleeves must be Rigid Galvanized Steel for penetrations of concrete slabs, concrete walls, and CMU walls.

2.6.3 Sleeves for penetrations of stud walls must be EMT.

2.6.4 All sleeves must be rigidly installed using appropriate fittings and all masonry penetrations must be grouted.

2.6.5 Sleeves must project a minimum of six (6) inches beyond wall or floor surface.

2.6.6 All penetrations of fire rated construction must be fire stopped with fire stopping as specified earlier or exceed fire rating of the penetrated material.

2.6.7 Sleeves for penetration of walls and floors must have one hundred percent (100%) spare capacity, and must be fire stopped as per code.

2.6.8 Any section of conduit containing two (2) 90-degree bends, a reverse bend, or having length greater than one hundred (100) feet must have an accessible pull box.

2.6.9 All conduits must have a 3/32-inch polyethylene pull cord appropriately secured at each end and replaced if used.

2.6.10 No oval or square conduit fittings must be permitted.

2.6.11 No screw type fittings must be permitted.

2.6.12 All metallic conduit and raceways must be appropriately grounded as specified in the National Electric Code.

2.6.13 An AWG #6 ground wire will be installed in both vertical risers from the basement to the top floor.

2.6.14 This ground must be attached to the building’s approved grounding point used for the building electrical service at one (1) point only.

2.6.15 A ground bus must be provided in each TC bonded to the communications ground system.

2.6.16 Each floor will be equipped with a center hung cable tray as Manufactured by OBO
Bettermann or equivalent from the telecommunications closet, above the suspended ceiling in corridors, to provide an access path to each communications outlet.

2.6.17 Three (3) 4” electrical metallic tubing (EMT) conduits will be installed to provide access to the center hung cable tray from the telecommunications closet.

2.6.18 The center hung cable tray must be installed as low as possible above the suspended ceiling and secured according to the National Electric Code.

2.6.19 If possible, at least 18” clearance above the center hung cable tray.

2.6.20 The telecommunications center hung cable tray should be on the opposite side of the ceiling space from cable ladder racks or other distribution used for electrical service.

2.6.21 Where possible, all 90-degree turns should be made by two (2) 45-degree turns.

2.6.22 Supports and fasteners must be used such that they provide an adequate safety factor.

2.6.23 All conduit/cable trays must be supported from the building structure and not from any other ductwork, pipes, ceiling tiles, or equipment.

2.6.24 All conduits should be a maximum of two (2) inches from any finished plywood wall.

2.6.25 Should ceiling space not allow for cable tray, contractor must install J-hooks, adequate for Category 6 cable, with a span of no greater than 4’ from hanger to hanger.

2.6.26 Where cable tray or conduit is not provided, J-hooks adequate for Category 6 cable must be installed.

2.6.27 The J-hooks must be attachable to a floor slab through the use of a pre-threaded lead insert which is suitable for installation of a 3/8 inch “all-thread” rod in a predrilled 1/2 inch hole.

2.6.28 The threads of the closure bolt on the pipe hanger must be covered by 3/8-inch copper or aluminum tubing to protect the cabling sheaths.

2.6.29 Cables placed in hangers in the plenum ceiling area must be routed high and away from all other electrical and mechanical systems so as to avoid contact with light fixtures, ventilation ducts, sprinkler systems or plumbing piping, motors, or any other electrical devices.

2.6.30 The cable must not be run in parallel with any high voltage electrical wiring.

2.6.31 The maximum separation between support points for all cabling must be four (4) feet.

2.6.32 Lay in pipe hangers must be installed so as to accommodate maximum distance spacing.

2.6.33 Hangers must be installed at directional bend points so as to provide a maximum bend angle of 45 degrees for the supported cabling.

2.6.34 Contractor must install 3/32 inch O.D., 200lb. Strength, polyethylene pulling string in each empty conduit, and appropriately secured at each end.
2.7 Telecommunication Rooms

2.7.1 Locations

2.7.1.1 The consultant must specify a single MDF on the lowest floor.

2.7.1.2 The consultant must specify one or more IDF’s as necessary given the layout of the building.

2.7.1.3 The consultant must vertically stack all TR’s centrally in the building.

2.7.1.4 If the building is too wide to allow for a single stack that provides coverage for the entire building, the consultant must design multiple vertical stacks of TR’s.

2.7.1.5 The consultant must minimize the number of TR’s by serving multiple floors from a single TR where possible.

2.7.1.6 The consultant must locate TR’s such that telecommunications cable can reach every point in the building with cables no longer than 90 meters run through the designed cable pathways.

2.7.1.7 If the MDF is located more than 50 feet from the point of penetration, the consultant must specify that each OSP conduit must extend to the MDF through RMT, as required by the NEC.

2.7.1.8 The consultant must design the dimensions of the hub rooms based on an estimate of each TR’s capacity and the TR clearance requirements included in this document.

2.7.1.9 The consultant must specify all of these requirements in writing during the conceptual design phase.

2.7.1.10 The consultant must specify these requirements in writing during design development.

2.7.1.11 The consultant must specify each TR during construction document development.

2.7.2 Dimensions

2.7.2.1 The consultant must ensure that the dimensions of each TR conforms to the specifications in this section.

2.7.2.2 The number of racks required for a TR and the clearance requirements for those racks constrain the possible dimensions.

2.7.2.3 The capacity of a TR determines the required number of racks.
2.7.2.4  The initial number of data drops in a TR plus its potential for growth over the lifetime of the TR is the TR’s capacity.

2.7.2.5  The consultant must determine the initial number of data drops for each TR.

2.7.2.6  The consultant must use the following table to determine the number of racks for each TR.

<table>
<thead>
<tr>
<th>Initial Capacity</th>
<th>Growth Potential</th>
<th>Capacity</th>
<th># of Racks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 192</td>
<td>192</td>
<td>384</td>
<td>1</td>
</tr>
<tr>
<td>&lt;= 384</td>
<td>384</td>
<td>768</td>
<td>2</td>
</tr>
<tr>
<td>&lt;= 576</td>
<td>576</td>
<td>1,152</td>
<td>3</td>
</tr>
<tr>
<td>&lt;= 768</td>
<td>768</td>
<td>1,536</td>
<td>4</td>
</tr>
</tbody>
</table>

2.7.2.7  The consultant must use 100% as the growth potential for a TR, as described in 2.7.6, unless the consultant can demonstrate that an increase or decrease is justified and the University approves the adjustment in writing.

2.7.2.8  The consultant must assume the footprint for all racks is 3 feet wide by 3 feet 6 inches deep, which includes vertical wire management on both sides of the rack.

2.7.2.9  The consultant must assume that side-by-side racks have their own vertical wire management on both sides and do not rack a common vertical wire manager. For clarity, side-by-side racks have the footprints shown in the following diagrams.

2.7.2.10 The consultant must estimate the capacity of each TR as its initial capacity plus an estimate of its potential for growth over the lifetime of the TR.

2.7.2.11 All racks must have a minimum 3 feet of clearance on the front, back, and one side.

2.7.2.12 The interior racks within a row of racks only require 3 feet of clearance in the front and back.

2.7.2.13 The 3 feet of clearance between racks placed one in front of the other, as would be the case for a narrow room, satisfies the clearance requirement for the back of the front rack and the front of the rear rack as illustrated in the following diagram.
2.7.2.14 If the room contains interior corners, columns, or other obstructions, the clearances apply to those features as well as the walls.

2.7.2.15 The clearance between a wall and a rack must take wall-mounted equipment into account. If wall mounted equipment such as 110 blocks, electrical circuits, etc., protrude 4” from the wall, the clearance between the rack and the wall must be 3’4”.

2.7.2.16 Electrical circuits mounted on racks are included the specified rack footprints.

2.7.2.17 Within these constraints, and the spirit of these constraints, the consultant must configure the room in any size and shape. However, to illustrate the intent, the following diagrams are examples of acceptable rack configurations and room dimensions.

2.7.2.18 The consultant must decide upon the dimensions of each TR in conjunction with the architect and document them at each submission during conceptual design, design development, and construction document development.

2.7.3 Electrical Requirements
2.7.3.1 All circuits must be dedicated.

2.7.3.2 There must be one duplex 15A, 120V circuit with 15-R receptacles placed on the wall to the left or right of the hub room’s entrance.

2.7.3.3 There must be one quad 15A, 120V, circuit, with 15-R receptacles placed on the back of the right-most rack if racks are in a row or the rear-most rack if racks are one in front of the other.

2.7.3.4 There must be two 20A, 220V, circuits, with a L6-20R receptacle placed on the back of every rack.

2.7.3.5 There must be one 30A, 220V, circuit with a L6-30R receptacle placed on the back of every rack.

2.7.3.6 There must be a telecommunications-grounding bar located in each hub room that must be and attached to an earth ground.

2.7.3.7 All equipment racks must be grounded to the telecommunications-grounding bus bar.

2.7.3.8 For buildings with one or two TR’s, the University will purchase and install a UPS unit for each rack in each TR.

2.7.3.9 For buildings with more than two hub rooms, the consultant must select an appropriately sized centralized flywheel UPS. This UPS must be in its own room and all circuits in each TR must connect to it either directly or via a sub panel.

2.7.3.10 All UPS units must be connected to circuits that are on a backup generator with an automatic transfer switch.
2.7.4 HVAC

The consultant must specify that TR’s:

2.7.4.1 Must have sufficient cooling to maintain a maximum temperature of 78°F for the lifetime of the room.

2.7.4.2 Must not receive heat from the building’s HVAC system during the winter.

2.7.4.3 Will generate 9,000 BTU/Hr. per rack, and use that figure to determine the TR’s cooling requirements.

2.7.5 Access & Security

The consultant must specify that each TR:

2.7.5.1 Is accessible directly from a hallway.

2.7.5.2 Has card-swipe access.

2.7.5.3 Must not have windows.
2.7.5.4 Must have doors must swing out.

2.7.5.5 Must have doors made of solid wood or metal, without windows or vents.

2.7.5.6 Must not contain building controllers, such as but not limited to, fire alarm, door access, HVAC, and lighting controllers.

2.7.6 Backboards

The consultant must specify:

2.7.6.1 Backboards on all walls of each TR.

2.7.6.2 Backboards are as specified in the Parts & Materials section of this document.

2.8 Radio Frequency Emissions

2.8.1 Overview

2.8.1.1 This section describes the University’s requirements for operating radio frequency emitting equipment on campus.

2.8.1.2 The requirements are divided into interoperability and approval, and safety requirements.

2.8.2 Interoperability & Approval

2.8.2.1 The University operates a wireless network campus wide, indoor and outdoor, that makes extensive use of the public frequency bands at 2.4 and 5 GHz.

2.8.2.2 The University operates a public safety radio system at 700 MHz.

2.8.2.3 The University must approve the use of all radio frequency emitting equipment on campus before it is used.

2.8.2.4 The requestor must provide the University with all relevant information, including but not limited to, frequencies used, output levels, power level predictions, etc., required for the University to make an informed decision.

2.8.3 Safety Requirements

2.8.3.1 All equipment must comply with all applicable rules and regulations of the FCC, including without limitation, those related to radio frequency emissions and exposure.

2.8.3.2 From time to time, but not more often than once per calendar year, the University may require the owner to perform a radio frequency emissions study sufficient to allow the University to determine whether or not the system is in compliance with applicable FCC rules and regulations related to radio frequency emissions and exposure. The owner must provide that survey at no cost to the University.
2.8.3.3 Should any such study show levels violating FCC rules or regulations, the owner shall provide a plan for the University’s review, for controlling access to affected areas, including but not limited to, markers, signage, door locks, rails, and fences, or otherwise cure the FCC violations.

2.8.3.4 Until such plan is implemented, Licensor may, by written notice to Licensee require Licensee must immediately power down the portion of the equipment causing such violations of FCC rules and/or regulations.
This section contains a list of acceptable parts and materials. The University requires specific manufacturer and part numbers for some parts and materials. The University defines performance characteristic for all other parts and materials. Any manufacturer/part number meeting the specified performance characteristics is acceptable.

Design consultants must incorporate this information into their construction documents. Bidders bidding on a contract must use this information to select materials upon which they will base their bids. Contractors performing work must use this information to order the appropriate parts and materials.

3.1 Backboards

3.1.1 Backboards must be:

3.1.1.1 3/4 –inch fire resistant plywood with Class A surface.

3.1.1.2 A minimum of 4’ x 8’.

3.2 Cable Supports

1. Cable supports for major hallways must be basket-type.

2. Cable supports for minor hallways must be j-hooks.

3. Cable supports for TR’s must be ladder rack.

4. Acceptable Manufacturer: GS Metals or similar.

3.3 Connecting Blocks

1. All optical fiber cable in all Intermediate Distribution Frame (IDF) rooms must be terminated in fiber termination shelves.

Acceptable unit for IDF’s: Corning (LANscape) CCH-03U w/CCH-CP12-91 connector panels

2. All optical fiber cable in the Main Distribution Frame (MDF) rooms must be terminated in fiber termination shelves and associated equipment.

Acceptable unit for IDF’s: Corning (LANscape) CCH-03U
Multi-mode:  CCH-CP12 - 91 connector panels
Single-mode:  CCH-CP12 – 59 connector panels
Acceptable unit for MDF’s:  Corning (LANscape) CCH-04U
Multi-mode:  CCH-CP12 – 91 connector panels
Single-mode:  CCH-CP12 – 59 connector panels

3.  All copper cabling must be Category 6.
   a.  All Category 6 cable utilized for data must be terminated on 48 port Ortronics HDJ Series 48 Port Unloaded Flat Panel Patch Panel, Ortronics Part OR-PHDHJU48.
   a.  Patch panel jacks designated for data or VoIP telephones must be Ortronics Clarity Category 6 High Density Jack, T568A/B, Orange, Ortronics Part # OR-HDJ6-43.
   b.  Patch panel jacks designated for wireless access points must be Ortronics Clarity Category 6 High Density Jack, T568A/B, Yellow, Ortronics Part # OR-HDJ6-44.
   c.  Patch panel jacks designated for security cameras must be Ortronics Clarity Category 6 High Density Jack, T568A/B, Green, Ortronics Part # OR-HDJ6-45.

4.  All analog lines will be terminated on 110 CAT6 blocks.
5. Quantities for all connecting blocks above will be specified by Towson University’s Office of Technology Services in project scope of work.

3.4 Equipment Racks

a. Equipment racks must be Mighty Mo 20 Channel Rack, 6.5” Deep Channel, 7’ High, 45RU, Tapped #12-24, Ortronics Part # OR-MM20706-B.

b. Vertical wire management must be Mighty Mo 20 Vertical Wire Managers with a Door, Otronics part #OR-MM20VMD710-B.

c. The contractor must provide four (4) Ortronics Mighty Mo 30 Bend Limiting Clips, Otronics part # OR-MM20BLC-B, per patch panel.

3.5 Fiber Optic Terminations

1. The installer must terminate all optical fiber cable installed with a split-ferrule alignment sleeve and a precision ceramic tip. All optical fiber connectors must meet the following technical specifications:

<table>
<thead>
<tr>
<th>Optical Fiber Termination Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector Type:</td>
</tr>
<tr>
<td>Fiber Outside Diameter:</td>
</tr>
<tr>
<td>Loss Repeat:</td>
</tr>
<tr>
<td>Axial Load Minimum:</td>
</tr>
<tr>
<td>Temperature Stability:</td>
</tr>
</tbody>
</table>

2. Acceptable Manufacturer: Corning

3.6 Fire Stopping

A fire stop system is comprised of: the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

All penetrations i.e. riser, slots and sleeves, and cables, through fire-rated building structures (walls and floors) must be sealed with E-Z Path Series 33 Fire Stop Barrier. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure).
Any penetrating items such as cable tray, raceways and conduit, etc. must use fire stopping protection that must meet NFPA Life Safety Code #101, 6-2.3.6, “Penetrations and Miscellaneous Openings and Fire Barriers” and the NEC 300.21 “Fire Stopping” regulations and standards.

3.7 Horizontal Cable

3.7.1 Horizontal UTP Cable

Horizontal distribution cable for data must be plenum rated twisted pair. Cable for wireless access points must be Category 6A. All other data and telephone cable must be Category 6.

The maximum distance for horizontal distribution cable from the telecommunications closet to wall jack must not exceed 90 meters without prior approval from Towson University’s Office of Technology Services.

The contractor must adhere to the following color-coding for twisted pair cabling:

- Wireless Access Point Cabling must be yellow.
- Security Camera Cabling must be green.
- All other data cabling must be orange.

Acceptable Manufacturer: Berk-Tek, Essex, or Mohawk

3.7.2 Horizontal Coaxial Cable

RG-6 Quad Shield, 75-Ohm Coaxial Cable, Plenum Rated
(Commscope: 2227K or equivalent)

Cable Construction
Center Conductor:
- 18AWG Copper-clad Steel
  - Nom. Dia.: .0403"

Dielectric:
- Foam: FEP
  - Dia. over Dielectric: 0.170” Nom.

Inner Shield:
- Foil: Aluminum/Poly Tape
  - Braid: 34 AWG Aluminum, 60% Coverage
  - Nom. Dia.: 0.312"

Outer Shield:
- Foil: Aluminum/Poly Tape
  - Braid: 34 AWG Aluminum, 40% Coverage
  - Nom. Dia.: 0.332"
Jacket:
Kynar Flex or Flame Retardant-PVC
Dia. over Jacket: 0.260” +/- .0004”
Nom. Jacket Thickness: 0.016”

Electrical Properties:
Sparker Test: 2500VAC
Dielectric Test: Conductor to Shield – 2000VDC
Capacitance: 15.5 pF./Ft. Nom.
Impedance: 76.0 +/- 2.0 Ohms
Velocity/Prop.: 84.0% Nom.
DCR: Conductor: 28.6 Ohms/1000 Ft. Nom
Shield: 5.30 Ohms/1000 Ft. Nom.

Acceptable manufacturer: Commscope or other approved manufacturer.

3.8 J-Hook Pathways

1. All J-hook pathways must support cable runs with a maximum spacing specified as not greater than four feet (4’) between J-hooks. Contractor must submit samples and cut sheets on proposed solutions for Towson University approval.

2. Acceptable Product: Caddy Cat J-Hooks

3.9 Outlet Boxes

1. All flush mount electrical J-boxes supporting standard voice/data/video communications must be flush-mounted double-gang galvanized steel boxes with single-gang raised tie covers.

2. All surface mounted boxes supporting standard voice/data/video communications must be double-gang Ortronics plastic boxes.

3. Acceptable Manufacturer: Ortronics

3.10 Outside Plant Cable

3.10.1 Outside Plant Fiber Optic Cable
### Building Interior

- **Air Core**

### Building Exterior

- Filled core stable from −40°F to +140°F

### Cable Composition

<table>
<thead>
<tr>
<th>Building Interior (Station, Plenum)</th>
<th>Fluoropolymer Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Interior (Station, Non-Plenum)</td>
<td>PVC Jacket</td>
</tr>
<tr>
<td>Building Interior (Riser)</td>
<td>PVC Jacket</td>
</tr>
<tr>
<td>Building Exterior (Riser)</td>
<td>Non-metallic dielectric</td>
</tr>
</tbody>
</table>

### Cable Strength

- Maximum pulling tension −600 lb.

### Minimum Bend Radii

- (<30% man. Pull tension) 10 times cable diameter
- (>30% max. pull tension) 20 times cable diameter

### Fiber Identification

- Color-coding system adequate to unambiguously identify each fiber. (See As-Built documentation) The words Fiber Optic Cable(s) must be imprinted on cable no more than one meter apart.

### 3.10.2 Acceptable manufacturer: any

### 3.11 Power Receptacles

ALL receptacle power for data equipment must be fed from standby power panels which are fed from standby or emergency generators via an automatic transfer switch.

1. Data equipment power must be run using all 10 AWG minimum stranded THHN wire in a 3/4” minimum EMT conduit with compression fittings.

2. Required receptacles include 208 volt single phase NEMA L6-20 and / or NEMA L6-30 and 120 volt single phase quad NEMA 5-20 receptacles. All receptacles are to be mounted in a 1910 box. All receptacles must be mounted on the back of the equipment racks only.

**NOTE:** Before ordering or installing data power, contact Towson University’s Office of Technology Services to verify the types of receptacles needed as well as quantities and locations of each type of receptacle.

### 3.12 Riser Cable

The structured cabling system with LAN equipment in each Main Distribution Frame (MDF) will require one 12-strand 8.3-micron single-mode optical fiber cable for backbone connectivity between the MDF and each Intermediate Distribution Frame (IDF). This cable must be jacketed as...
appropriate for use in a riser or plenum environment. Backbone optical fiber cable must be colored yellow to denote single-mode fiber.

3.12.1 Copper Riser Cable

1. All UTP riser copper cable supporting voice communications requirements must be standard 24-gauge, paired dual, semi-rigid PVC skin over foamed PE, and must meet the following technical specifications:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Resistance</td>
<td>25.7 Ohms/1000 ft</td>
</tr>
<tr>
<td>Gauge</td>
<td>24 AWG, solid copper conductor, twisted pair</td>
</tr>
<tr>
<td>Mutual Capacitance</td>
<td>15.8 pF/ft</td>
</tr>
<tr>
<td>Characteristic Impedance</td>
<td>650 Ohms @ 1 kHz 105 Ohms @ 1MHz</td>
</tr>
</tbody>
</table>

2. The attenuation of any pair must not exceed the following values:

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Maximum Attenuation (dB per 305 m @ 20 deg. C.) (dB per 1000 ft @ 20 deg. C.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.002</td>
<td>0.8</td>
</tr>
<tr>
<td>0.008</td>
<td>1.5</td>
</tr>
<tr>
<td>0.064</td>
<td>2.8</td>
</tr>
<tr>
<td>0.256</td>
<td>4.0</td>
</tr>
<tr>
<td>0.512</td>
<td>5.6</td>
</tr>
<tr>
<td>0.772</td>
<td>6.7</td>
</tr>
<tr>
<td>1.0</td>
<td>7.6</td>
</tr>
<tr>
<td>4.0</td>
<td>15.4</td>
</tr>
<tr>
<td>8.0</td>
<td>22.3</td>
</tr>
<tr>
<td>10.0</td>
<td>25.0</td>
</tr>
<tr>
<td>16.0</td>
<td>32.0</td>
</tr>
</tbody>
</table>

3. The characteristic impedance of any pair must meet the following requirements:

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Characteristic Impedance (Ohms.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.064</td>
<td>120 +/- 15%</td>
</tr>
<tr>
<td>0.128</td>
<td>110 +/- 15%</td>
</tr>
<tr>
<td>0.256</td>
<td>105 +/- 15%</td>
</tr>
</tbody>
</table>
4. The Near-End Cross talk (NEXT) coupling loss between pairs within a cable must be equal to or greater than the following:

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>NEXT Loss Worst Pair (dB @ 305 m) (dB @ 1000 ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.150</td>
<td>52</td>
</tr>
<tr>
<td>0.772</td>
<td>41</td>
</tr>
<tr>
<td>1.576</td>
<td>37</td>
</tr>
<tr>
<td>3.15</td>
<td>32</td>
</tr>
<tr>
<td>6.3</td>
<td>28</td>
</tr>
<tr>
<td>10.0</td>
<td>25</td>
</tr>
<tr>
<td>16.0</td>
<td>23</td>
</tr>
</tbody>
</table>

5. Acceptable Manufacturer: Berk-Tek or Ortronics or other approved manufacturer

3.12.2 Fiber Optic Riser Cable

2. All backbone Optical Fiber must be 8.3-micron single-mode fiber.

<table>
<thead>
<tr>
<th>Core Type:</th>
<th>Graded Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Diameter:</td>
<td>8.3 (+/- 6) microns</td>
</tr>
<tr>
<td>Core Eccentricity:</td>
<td>1.5% Nominal – 7.5% Max.Core</td>
</tr>
<tr>
<td>Ovaity:</td>
<td>4% Nominal – 20% Max</td>
</tr>
<tr>
<td>Cladding Diameter:</td>
<td>125 (+/- 2) microns</td>
</tr>
<tr>
<td>Cladding Non-Circularity:</td>
<td>2% Maximum</td>
</tr>
<tr>
<td>Coating Diameter:</td>
<td>245 (+9/-13) microns</td>
</tr>
<tr>
<td>Refracting Index Delta:</td>
<td>2.0% (+/- .3%)</td>
</tr>
<tr>
<td>Numerical Aperture:</td>
<td>0.29</td>
</tr>
<tr>
<td>Bandwidth Windows:</td>
<td>Dual-850 nm – 3.5 dB</td>
</tr>
<tr>
<td>Maximum Attenuation:</td>
<td>850 nm – 3.5 dB</td>
</tr>
<tr>
<td></td>
<td>1300 nm – 1.5 dB</td>
</tr>
<tr>
<td>Typical Bandwidth:</td>
<td>850 nm – 400 MHz/km</td>
</tr>
<tr>
<td></td>
<td>1300 nm – 500 MHz/km</td>
</tr>
</tbody>
</table>
3. All fiber cable used must have the following physical characteristics:

<table>
<thead>
<tr>
<th>Fiber Optic Cable Physical Characteristics</th>
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<td><strong>Cable Core</strong></td>
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<td><strong>Cable Strength</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Fiber Identification</strong></td>
</tr>
</tbody>
</table>

4. Acceptable Manufacturer: Any

3.12.3 Coaxial Riser Cable

RG-11 Quad Shield, 75-Ohm Coaxial Cable, Plenum Rated  
(Commscope: 22827K or equivalent)

Cable Construction
- **Center Conductor:** 18AWG Copper-clad Steel  
  Nom. Dia.: .0641”

**Dielectric:**
- Foam: FEP  
  Dia. over Dielectric: 0.28” Nom.

**Inner Shield:**
- Foil: Aluminum/Poly Tape  
  Braid: 34 AWG Aluminum, 60% Coverage

Parts & Materials
Nom. Dia.: 0.312”

Outer Shield:
- Foil: Aluminum/Poly Tape
- Braid: 34 AWG Aluminum, 40% Coverage
Nom. Dia.: 0.332”

Jacket:
- Flame Retardant PVDF Jacket
Dia. over Jacket: 0.372”
Nom. Jacket Thickness: 0.020”

Electrical Properties:
- Capacitance: 16pF/ft
- Impedance: 76.0 +/- 3.0 Ohms
- Velocity/Prop.: 84.0% Nom.
- Max DC Loop Resistance 3.90 Ohms/1000 Ft. Nom

### 3.13 Splice Cases

All building entrance Splice Cases must be 3-M type closure and accessories.

### 3.14 Unspecified Equipment

1. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional PDS installation must be provided in a level of quality consistent with other specified items. Towson University must retain the right to review and approve all products not specified.
3.15 Voice/Data Jacks and Cover Plates

1. Jacks must be Ortronics TracJack OR-TJ600-23 (light orange in color) for data drops and Ortronics TracJack OR-TJ600 (white in color) for analog voice drops.

2. Faceplates must be white in color.

3. The “pin-out” wiring assignment for the 4 pair UTP copper cable for data communications at the outlet jack and at the TC connection must be consistent with EIA/TIA T568B. The “pin-out” wiring assignment for the 4 pair UTP copper cable for voice communications will be as specifically stated on Page 22, Station Cabling and Installation.

4. Back to back outlets in the same wall or thru-wall type boxes are not permitted. To maximize sound control, outlets on opposite sides of a common wall must be offset at least 6 inches.

5. Station outlet boxes must be installed at the same elevation as the other outlets in the room. As a general guideline. Mount the station outlet boxes as follows: (dimensions are from the finished floor to the center line of unobstructed outlets)

   - Standard Communications Outlet - 18”
   - Wall mounted, where wheel chair persons can only approach head-on - 4'0”

6. Video connectors should be “F” type with female connections on each end.

7. Standard Communication Outlet Layout
7. Acceptable Product: Ortronics TracJack
### 4.1 General Execution Requirements

The contractor must execute all work in accordance with this document, BISCI, EIA/TIA, NFPA, NEC, and IEEE standards, whichever is most stringent. The requirements listed here highlight specific requirements which the University considers important or otherwise feels it needs to specifically state.

The contractor must:

1. Execute all work in accordance with this document, BISCI, EIA/TIA, NFPA, NEC, and IEEE standards, whichever is most stringent.
2. Install cable system in a manner that provides mechanical integrity for the cabling media and any associated frames and racks and allows for ease of access.
3. Install cable in cable trays, j-hooks, conduits, sleeves, and chases, when such supports exist.
4. Install appropriate carriers to support installed cabling where appropriate support does not exist.
5. Install cable support systems such as J-hooks or other carriers that do not provide continuous cable support at intervals no greater than 3 feet.
6. Install cable service loops above ceilings over jack locations.
7. Verify that installation sites are ready to begin work before beginning work.
8. Coordinate their work with Towson University and appropriate trades involved with project.
9. Verify the locations for ladder racks, equipment racks, patch panels, and wire management with the University’s Office of Technology Services in all IDF and MDF’s prior to beginning their installation.

### 4.2 Unacceptable Work

The University prohibits the following except where specifically indicated in construction drawings or scope of work, or when authorized by the University’s Office of Technology Services in writing prior to execution. Specifically, the contractor must not:

1. Splice copper, coaxial, UTP, or any other telecommunications cable inside a building.
2. Install cable aerially.
3. Attach cable to anything other than the telecommunications cable support system.

4. Attach cable supports to anything other than the building structure.

5. Install cable or cable supports where interferes with the operation or maintenance of any other building systems or components, or impairs access to the same.

6. Lay cable on the ceiling grid, lighting fixtures, or other cables.

7. Attach cable support systems to anything other than the concrete deck.

8. Install service loops for cable inside any IDF or MDF.


### 4.3 Coordination with Other Trades

1. All cable in accessible spaces must be designed and installed for easy access. Cable paths above suspended ceilings, mechanical rooms, closets, etc., must not be blocked or covered in any way that would impede the addition of cable in the future.

### 4.4 Labeling

Towson University’s labeling standard is based on the 606A labelling standard. As such, it uses specific identifiers, which are defined in this section.

#### 4.4.1 TR ID

A TR ID’s is a two-character identifier, such as “1A”, “2C”, or “3A”, where the characters correspond to the floor number and a closet letter that uniquely identifies it on its floor. The contractor must obtain the list of TR ID’s from the Office of Technology Services.

#### 4.4.2 Patch Panel ID

A Patch Panel ID is a single capital letter that uniquely identifies a patch panel within a TR. Patch panel “A” is assigned to the top patch panel in the left-most rack. The other patch panels ID’s are assigned alphabetically, from top to bottom of each rack, then from left-most rack to right-most rack. In cases where racks are one in front of the other, the labels go top to bottom of each rack, then from front-most rack to rear-most rack. The drawing below shows how to assign Patch Panel ID’s.
4.4.3 Patch Panel Jack ID

The Patch Panel Jack ID is a zero-padded two-digit number that uniquely identifies a jack on a patch panel. Patch Panel ID’s are 1-48. Most panels already have jack labelled 1-48. However, if the panel is not labelled, or labelled in another manner, the contractor label the panels jacks 1-48 with the top row being 1-24 from left to right and the bottom row being 25-48 from left to right.

4.4.4 End Station Jack ID

End Station Jack ID’s identify a specific cable installed in a faceplate at the end station location. It has the following format: AA-BC, where AA is the TR ID, B is the Patch Panel ID, and C is the Patch Panel Jack ID. For example, “1B-C32” indicates the cable goes to the telecommunications room with TR ID “1B” and terminates on patch panel C, on patch panel jack 32.

For horizontal cable, the contractor must:

1) Request labeling instructions from the University’s Office of Technology Services prior to the start of labeling if the construction document or scope of work does not contain labeling instructions.

2) Request that the University provide the 606A TR ID’s for each telecommunications room prior to beginning work.

3) Affix a label to the left-hand side of each patch panel that contains the patch panel’s Panel ID.
4) Affix a label containing the Patch Panel Jack ID under each patch panel jack if the patch panel does not already contain Patch Panel Jack ID’s.

5) Affix a label in the label slot on each faceplate that provides the End Station Jack ID for each cable terminated in it.

6) Affix a label with the End Station Jack ID within 4 inches of the end of all end-station cables terminated with an RJ45 on the end-station side.

7) Print all labels with a label making device.

For riser cable, the contractor must:

1. Affix a label containing the Cable ID within 12 inches of:
   a. Entering and exiting an LIU.
   b. Entering and exiting a splice case.
   c. Entering and exiting a conduit, wall or floor penetration, or any other area where the cable disappears from view.

2. Affix an LIU Module Label to the outside of each LIU for each module where the contractor terminated a strand of fiber.

4.4.5 Fiber Optic Riser Cables

Each fiber optic riser cable has an identifier of the following form: AA/BB-CC, where AA is the TR ID of the MDF, BB is the TR ID of the IDF, and CC is a zero-padded 2-digit number that makes the label unique. For example, if the first cable run between TR 1A and 2B is 1A/2B-01, the second is 1A/2B-02, etc.

For each cable, the contractor must affix a label containing the cable’s identifier within 12 inches of:

1. Entering an LIU.

2. Entering or leaving a splice case.

3. Entering or exiting a conduit, penetration, or any other area where it disappears from view.

The contractor must also affix labels to the LIU to indicate where the individual strands are terminated. These labels must be of the following form:

Module Letter: End Station Jack ID 1.A - End Station Jack ID.B, where A is the first strand number terminated on the module and B is the last.

For example, if a 48-strand cable is terminated in slots A, B, C, and D, the contractor must affix a label to the LIU that looks like this:
4.4.6 Fiber Optic OSP Cables

4.4.7 Copper Cables

4.5 Grounding and Bonding Requirements

The facility must be equipped with a Telecommunications Bonding Backbone (TBB). This backbone must be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor.

1. The TBB must be installed independent of the building’s electrical and building ground and must be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

2. The main entrance facility/equipment room in each building must be equipped with a telecommunications main grounding bus bar (TMGB).

3. Each telecommunications room must be provided with a telecommunications ground bus bar (TGB).

4. The TMGB must be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

5. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MDF or IDF must be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

6. All wires used for telecommunications grounding purposes must be identified with a green insulation. Non-insulated wires must be identified at each termination point with a wrap of green tape. All cables and bus bars must be identified and labeled in accordance with the System Documentation Section of this specification.

7. All ladder rack installed in hallways must be grounded and bonded.
4.6 Testing and Inspection

1. Upon completion of the project, Towson University’s OTS Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Owner.

2. Upon receipt of the test documentation, Towson University reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Towson University testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found the contractor will be notified for resolution.

3. Prior to acceptance, all “As-Built” and technical documentation must be received and approved by the University. As-built documentation must include the completed and notarized original copy of the Premises Distribution System Registration Document, if applicable. All intra-building and inter-building wiring and equipment, and all site restoration must be installed and completed in accordance with Towson University and industry standards. All wiring and equipment provided and/or installed under this contract must be tested as described under the terms of this contract and must be fully operational. After all work is complete, the Contractor must also provide Towson University with Structured Cabling System Certification for all communications work completed on the project.

4. Testing of all copper wiring must be performed prior to system cutover. 100 percent of the horizontal and rise wiring pairs must be tested for opens, shorts, polarity reversals, transpositions and presence of AC voltage. Voice and data horizontal wiring pairs must be tested from the information outlet to the TC. The Category 6 cable runs for data communications must be tested for conformance to the specifications of EIA/TIA 568B Category 6. Testing must be done with a TIA/EIA TSB-67 UL Certified Level 2 test set. The Category 6 cable runs for voice communications must be tested for continuity only. Test must include length, mutual capacitance, characteristic impedance, attenuation, and near end and far end cross talk. The contractor, at no charge, must bring any pairs not meeting the requirements of the standard into compliance.

5. Fiber testing must be performed on all fibers in the completed end-to-end system. Testing must consist of a bi-directional end to end OTDR trace performed per EIA/TIA 455-61 for OSP and a bi-directional end to end power meter test performed per EIA/TIA 455-53A for ISP. The system loss measurements must be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.

6. Complete, end-to-end test results for all installed fiber & copper cabling must be submitted to Towson University in one (1) Microsoft Excel 2000 (.xls) soft copy file and one (1) hard copy.
4.7 System Performance

During the three (3) week period between final inspection and delivery of the test and as-built documentation, Towson University will activate the cabling system. Towson University will validate operation of the cabling system during this period.

4.8 Final Acceptance

Completion of the installation; in-progress and final inspections; receipt of the test and as-built documentation; and successful performance of the cabling system for a three (3) week period will constitute acceptance of the system.

4.9 As Built Documentation

1. The contractor must provide the following outside plant wiring information, prior to acceptance of the building by Towson University, for each of the specified media:
   a. End Station Jack Identification number (Copper).
   b. Cable design makeup (Copper).
   c. Cable lengths between splice points.
   d. Exact routing of cable (Copper).
   e. Splice location and identification (Copper).
   f. Bonding and grounding (Copper, Fiber, Coax).
   g. Location and description of all associated equipment (Copper).
   h. Location and description of all associated structures and obstructions (Copper).

2. The contractor must provide the following intra-building wiring information for each specified media prior to acceptance of the building by Towson University:
   a. Cable entrance locations and penetrations details (copper).
   b. Location and identification of all distribution closets and of all equipment located inside distribution closets (Copper).
   c. Terminal information, jack numbering, and pair count information at each distribution frame (Copper).
   d. Schematic drawings of riser (Copper).
   e. Routing of cable and termination information (Copper).
3. The Contractor must provide the following MDF wiring information prior to acceptance of the building by Towson University:
   
   a. Cable pair assignments per connector block.
   
   b. Identification of cable routing to MDF (1st Floor).

4. The Contractor must provide a complete listing of pair assignment records for copper wiring. Copper cable records must include the status of each copper pair.

5. The Contractor must provide Towson University with the operational and maintenance documentation of all telecommunications equipment installed under this contract.

6. Contractor must submit all drawings electronically utilizing AutoCAD version (xxx).

7. Cable test results will be submitted in Microsoft Excel 2000 spreadsheet (.xls) format.

4.10 Warranty

1. The contractor must warrant and guarantee to Towson University, without limitations or qualifications that all equipment, components, material and workmanship must perform in accordance with local and national codes and the specifications of this document.

2. The warranty period must be for two (2) years from the time of final acceptance by Towson University.
## 5 Glossary of Terms

<table>
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<th>Definition</th>
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<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>AWG</td>
<td>American wire gauge</td>
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<tr>
<td>BISCI</td>
<td>Building Industry Consulting Service International</td>
</tr>
<tr>
<td>CMP</td>
<td>Communications Plenum Cable</td>
</tr>
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<td>End Station device</td>
<td>A location outside of a TR at which a person connects a data network or telephone</td>
</tr>
<tr>
<td>EIA/TIA (TIA)</td>
<td>Electronic Industry Association (EIA)/Telecommunications Industry Association</td>
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<tr>
<td>EMT</td>
<td>Electrical metallic tubing</td>
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<tr>
<td>FEP</td>
<td>Fluorinated Ethylene Propylene</td>
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<tr>
<td>IDF</td>
<td>Intermediate distribution frame</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>Installer</td>
<td>A person or company that installs IT infrastructure defined in this document.</td>
</tr>
<tr>
<td>ISP</td>
<td>Inside Plant</td>
</tr>
<tr>
<td>MDF</td>
<td>Main distribution frame</td>
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<tr>
<td>NEC</td>
<td>National Electrical Code</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
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<tr>
<td>OFNP</td>
<td>Optical Fiber Nonconductive Plenum</td>
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<tr>
<td>OSP</td>
<td>Outside Plant</td>
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<tr>
<td>OTDR</td>
<td>Optical Time Domain Reflectometer</td>
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<tr>
<td>PBX</td>
<td>Private Branch Exchange</td>
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<tr>
<td>PE</td>
<td>Polyethylene</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinyl Chloride plastic</td>
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<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>RMT</td>
<td>Rigid Metallic Tubing</td>
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<tr>
<td>TGB</td>
<td>Telecommunications grounding bus bar</td>
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<tr>
<td>TMGB</td>
<td>Telecommunication’s main grounding bus bar</td>
</tr>
<tr>
<td>TR</td>
<td>Telecommunications Room (an IDF or MDF)</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriter's Laboratory</td>
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<tr>
<td>UTP</td>
<td>Unshielded twisted pair</td>
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6 Change Log
New cable run
Existing cable, may need to move few feet

ENROLLMENT SERVICES
THIRD FLOOR
Cisco Aironet 3800 Series Access Points
Contents

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Features and Benefits 3
Product Specifications 7
Warranty Information 17
Cisco Capital 17
The Cisco® Aironet® 3800 Series Wi-Fi access points are highly versatile and deliver the most functionality of any access points in the industry.

Product Overview

For organizations paving the way for the new 802.11ac Wave 2 standard, the Cisco Aironet 3800 Series is the perfect solution. The access points go beyond getting ready for the new standard, providing the ultimate in flexibility and versatility.

For large enterprise organizations that rely on Wi-Fi to engage with customers, the 3800 Series is a hands-off product that’s intelligent enough to make decisions based on end-device activities and usage. This automation allows you to devote time to other pressing matters, secure in the knowledge that your Wi-Fi network is performing to its utmost potential.

The Aironet 3800 Series is packed with the features and capabilities that have made Cisco the industry leader, at a price point that is ideal for managing wireless growth, capacity, and coverage gaps in dense indoor environments.

Features and Benefits

<table>
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<th>Feature</th>
<th>Benefit</th>
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<tr>
<td>802.11ac Wave 2 support</td>
<td>Provides a theoretical connection rate of up to 2.6 Gbps per radio—roughly double the rates offered by today’s high-end 802.11ac access points.</td>
</tr>
<tr>
<td>High-density experience</td>
<td>Best-in-class RF architecture that provides high-performance coverage for a high density of client devices, giving the end user a seamless wireless experience. Features include custom hardware in 802.11ac Wave 2 radios, Cisco CleanAir®, Cisco Client Link 4.0, cross-access point noise reduction, and an optimized client roaming experience.</td>
</tr>
<tr>
<td>Multiuser Multiple-Input Multiple-Output (MU-MIMO) technology</td>
<td>Supporting three spatial streams, MU-MIMO enables access points to split spatial streams between client devices, to maximize throughput.</td>
</tr>
<tr>
<td>Multigigabit Ethernet support</td>
<td>Providing multiple gigabit uplink speeds of 2.5 Gbps and 5 Gbps in addition to 100-Mbps and 1-Gbps speeds. All speeds are supported on Category 5e cabling for an industry first, as well as 10GBASE-T(IEEE 802.3b2) cabling.</td>
</tr>
<tr>
<td>Feature</td>
<td>Benefit</td>
</tr>
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<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Flexible Radio Assignment</td>
<td>Allows the access points to intelligently determine the operating mode of serving radios based on the RF environment. The access points can operate in the following modes:</td>
</tr>
<tr>
<td></td>
<td>● 2.4-GHz and 5-GHz mode: One radio serves clients in 2.4-GHz mode, while the other serves clients in 5-GHz mode</td>
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<tr>
<td></td>
<td>● Dual 5-GHz mode: Both radios inside the access point operate on the 5-GHz band, maximizing the benefits of 802.11ac Wave 2 and increasing client device capacity</td>
</tr>
<tr>
<td></td>
<td>● Wireless Security Monitoring and 5-GHz mode: One radio serves 5-GHz clients while the other is scanning the full spectrum for attackers, RF interference, and rogue devices</td>
</tr>
<tr>
<td>Dual 5-GHz radio support</td>
<td>Enables both radios to operate in 5-GHz client serving mode, allowing an industry-leading 5.2 Gbps (2 x 2.6 Gbps) over-the-air speed while increasing client capacity.</td>
</tr>
<tr>
<td>Smart antenna connector</td>
<td>An intelligent second physical antenna connector is included on 3800 Series models with an external antenna. This connector provides advanced network design flexibility for high-density and large open-area environments such as auditoriums, convention centers, libraries, cafeteria, and arenas/stadiums, allowing two sets of antennas to be connected and active on a single access point.</td>
</tr>
<tr>
<td>Modular architecture</td>
<td>Second-generation modular architecture first introduced by the 3600 Series access points. New side-mount connection allows companies to add and remove modules as needed without having to dismount the access point from the ceiling, further simplifying the customer’s time and dollars when performing network upgrades.</td>
</tr>
<tr>
<td></td>
<td>The new side-mount architecture allows for additional flexibility in the form factor of a 3800 Series module, and in the choice of solutions with integrated or even external antennas of their own.</td>
</tr>
<tr>
<td></td>
<td>We have doubled the amount of power available to 3800 Series modules from 9W to 18W, broadening the potential module applications and solutions.</td>
</tr>
<tr>
<td>160-MHz channel support</td>
<td>Supporting channels up to 160 MHz wide, Dynamic Bandwidth Selection allows the access point to dynamically switch between 20-, 40-, 80-, and 160-MHz channels, depending on the RF channel conditions, providing the industry’s best-performing wireless network.</td>
</tr>
<tr>
<td>Zero-impact Application Visibility and Control*</td>
<td>Uses dedicated hardware acceleration to improve the performance of line-speed applications such as Cisco Application Visibility and Control.</td>
</tr>
<tr>
<td>Cisco ClientLink 4.0</td>
<td>Cisco ClientLink 4.0 technology improves downlink performance to all mobile devices, including one-, two-, and three-spatial-stream devices on 802.11a/b/g/n/ac while improving battery life on mobile devices such as smartphones and tablets.</td>
</tr>
<tr>
<td>Cisco CleanAir 160 MHz*</td>
<td>Cisco CleanAir technology, enhanced with 160-MHz channel support, provides proactive, high-speed spectrum intelligence across 20-, 40-, 80-, and 160-MHz-wide channels to combat performance problems due to wireless interference.</td>
</tr>
<tr>
<td>Cross-access point noise reduction</td>
<td>A Cisco innovation that enables access points to intelligently collaborate in real time about RF conditions so that users connect with optimized signal quality and performance.</td>
</tr>
<tr>
<td>Optimized access point roaming</td>
<td>Helps ensure that client devices associate with the access point in their coverage range that offers the fastest data rate available.</td>
</tr>
<tr>
<td>Automatic link aggregation (LAG) support</td>
<td>802.3ad (Link Aggregation Control Protocol [LACP]) compliant, allowing both Ethernet interfaces to automatically enable LAG, increasing overall throughput to the access point.</td>
</tr>
<tr>
<td>Cisco Mobility Express</td>
<td>Flexible deployment mode through the Cisco Mobility Express solution is ideal for high density environments and can support up to 100 access points. Easy setup allows the 3800 Series access points to be deployed on networks without a physical controller.</td>
</tr>
</tbody>
</table>
Apple Features

Apple and Cisco have responded to this challenge by partnering to create an optimal mobile experience for iOS devices on corporate networks based on Cisco® technologies. Specifically, using new features in iOS 10 in combination with the latest software and hardware from Cisco, businesses can now more effectively use their network infrastructure to deliver an enhanced user experience across all business applications. At the center of the collaboration is a unique handshake between Cisco WLAN and Apple devices. This handshake enables Cisco WLAN to provide an optimal Wi-Fi roaming experience to Apple devices. Additionally, Cisco WLAN trusts Apple devices and gives priority treatment for business-critical applications specified by the Apple device.

802.11ac Wave 2 and beyond

The Aironet 3800 Series extends 802.11ac speed and features to a new generation of smartphones, tablets, and high-performance laptops, providing a greater end-user experience. Whether your project involves wholesale changes to your current wireless network or upgrading your legacy Wi-Fi deployments (802.11a/b/g/n/ac Wave 1 deployments), the Aironet 3800 Series can handle the job.

The Aironet 3800 Series supports 802.11ac Wave 2, providing a theoretical connection rate of up to 5.2 Gbps—that's roughly four times the rate offered by today's high-end 802.11ac access points. The boost helps you stay ahead of the performance and bandwidth expectations of today's mobile worker, who usually uses multiple Wi-Fi devices instead of just one. As such, users are adding proportionally larger traffic loads to the wireless LAN, which has outpaced Ethernet as the default enterprise access network.

Cisco DNA support

Pairing the 3800 Series access points with the Cisco Digital Network Architecture (Cisco DNA™) allows for a total network transformation. Cisco DNA allows you to truly understand your network with real-time analytics, quickly detect and contain security threats, and easily provide networkwide consistency through automation and virtualization. By decoupling network functions from the hardware, you can build and manage your entire wired and wireless network from a single user interface.

Working together, the 3800 Series and Cisco DNA offer such features as:

- Flexible Radio Assignment
- Cisco Connected Mobile Experiences
- Cisco High Density Experience
- Apple FastLane
- Cisco Identity Services Engine
- And much more

The result? Your network stays relevant, becomes digital-ready, and is the lifeblood of your organization.
High-density experience

Building on the Cisco Aironet heritage of RF excellence, the Cisco Aironet 3800 Series Access Points run on a purpose-built, innovative chipset with a best-in-class RF architecture. This chipset provides a high-density experience for enterprise networks designed for mission-critical, high-performance applications. The 3800 Series is part of Cisco’s flagship portfolio of 802.11ac-enabled access points, delivering a robust mobility experience. It features 802.11ac Wave 2 with 4x4 MU-MIMO technology supporting three spatial streams. MU-MIMO enables access points to split spatial streams between client devices, to maximize throughput.

With two radios built into each access point, the Aironet 3800 Series is more versatile than any access point currently on the market. These radios are outfitted with Flexible Radio Assignment, which means that the access points automatically self-optimize to better serve the environment. For example, one of the radios broadcasts its signal on the 5-GHz channel and the other sends out a 2.4-GHz signal. The access point understands the wireless environment and will automatically switch the 2.4-GHz signal to a 5-GHz signal, increasing the reliability of your customers’ Wi-Fi use. This setting automatically works in reverse too: the access point can recognize that the RF environment has changed and revert back to its original configuration.

The 3800 Series also dynamically changes the radio settings based on the wireless environment. The access point will allow one of the radios to operate in Wireless Security Monitoring mode, allowing you to detect wireless security threats and interference and combat rogue access. This valuable information can be culled in an easy-to-understand matrix to inform you about your wireless users. Flexible Radio Assignment also allows you to convert a radio into Wireless Service Assurance mode, providing proactive health monitoring of the network.

- **Optimized access point roaming** helps ensure that client devices associate with the access point in their coverage range that offers the fastest data rate available
- **Cisco ClientLink 4.0** improves downlink performance to all mobile devices, including one-, two-, and three-spatial-stream devices on 802.11a/b/g/n/ac. At the same time, the technology improves battery life on mobile devices
- **Cisco CleanAir** is technology enhanced with 160-MHz channel support. It delivers proactive, high-speed spectrum intelligence across 20-, 40-, and 80-, and 160-MHz-wide channels to combat performance problems due to wireless interference
- **MIMO equalization capabilities** optimize uplink performance and reliability by reducing the impact of signal fade
- **Apple roaming features** such as 802.11r Fast Transition, 802.11v BSS Transition, and Assisting Roaming enables Cisco WLAN to provide an optimal Wi-Fi roaming experience to Apple devices
Modular architecture

The 3800 Series carries forward the modular architecture first introduced with the Aironet 3600 Series, providing unparalleled investment protection for forward-looking modular solutions. The 3800 Series delivers an enhanced second-generation modular architecture in the following ways:

- **Moving the module connection from the bottom to the side of the access point.** This allows for easier addition and removal of a module without having to dismount the access point and also allows for flexibility in module design with respect to size and appropriate antenna placement.

- **Increasing the power available to a module to 18W**, providing additional flexibility for future module solutions.

- **The Cisco Aironet Developer Platform** framework works in tandem with the Aironet 3800 Series as the perfect solution, allowing your network to work for you. Modularity brings intent-based networking to the edge, customizing your ability to tackle new use cases and emerging technology standards, so that your deployments are ready for the future. The Cisco Aironet Developer Platform program transforms the access point into a powerful development platform for mobility and IoT convergence.

- **The Cisco Beacon Point Module** is the virtual beacon solution that is leading the way in the indoor location-based services space. Cisco technology brings both easy deployment and superior location accuracy to the industry. All it takes to move a virtual beacon is a mouse click and technologies that can identify assets from 1 to 3 meters away. The Cisco Beacon Point Module is the perfect add-on to augment your Cisco Aironet 3800 Series Access Point and will strengthen your wireless network. This solution is well suited to industries such as retail (properly engage customers), healthcare (accurately track assets), and offices (optimize workspaces).

As wireless LAN continues to grow as the dominant method of connecting to private and public networks, the access point becomes a perfect integration point into an enterprise corporate network or carrier service network for a wide variety of solutions. Companies can use a single Ethernet cable drop from their wired network to provide high-speed network access and also typically for Power over Ethernet (PoE) to the access point and solutions that are integrated with and interconnected through the 3800 Series access points.

### Product Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
</table>
| Part numbers | **Cisco Aironet 3800i Access Point: Indoor environments, with internal antennas**  
- AIR-AP3802I-x-K9: Dual-band, controller-based 802.11a/b/g/n/ac  
- AIR-AP3802I-xK910: Eco-pack (dual-band 802.11a/b/g/n/ac) 10 quantity access points  
- AIR-AP3802I-D-K9I: Dual-band, controller-based 802.11a/b/g/n/ac (India only) |
| | **Cisco Aironet 3800i Access Point Configurable: Indoor environments, with internal antennas**  
- AIR-AP3802I-x-K9C: Dual-band, controller-based 802.11a/g/n/ac, configurable  
- AIR-AP3802I-xK910C: Eco-pack (dual-band 802.11a/g/n/ac) 10 quantity access points, configurable |
| | **Cisco Aironet 3800e Access Point: Indoor, challenging environments, with external antennas**  
- AIR-AP3802E-x-K9: Dual-band controller-based 802.11a/b/g/n/ac  
- AIR-AP3802E-xK910: Eco-pack (dual-band 802.11a/b/g/n/ac), 10 quantity access points |
| | **Cisco Aironet 3800e Access Point Configurable: Indoor, challenging environments, with external antennas**  
- AIR-AP3802E-x-K9C: Dual-band controller-based 802.11a/g/n/ac, configurable  
- AIR-AP3802E-xK910C: Eco-pack (dual-band 802.11a/g/n/ac), 10 quantity access points, configurable |
<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
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</thead>
</table>
| **Cisco Aironet 3800p Access Point: Indoor, challenging environments, with external antennas** |  - AIR-AP3802p-x-K9: Dual-band controller-based 802.11a/b/g/n/ac  
  - AIR-AP3802p-xK910: Eco-pack (dual-band 802.11a/b/g/n/ac), 10 quantity access points |
| **Cisco Aironet 3800p Access Point Configurable: Indoor, challenging environments, with external antennas** |  - AIR-AP3802p-x-K9C: Dual-band controller-based 802.11a/g/n/ac, configurable  
  - AIR-AP3802p-xK910C: Eco-pack (dual-band 802.11a/g/n/ac), 10 quantity access points, configurable |
| **Cisco Smart Net Total Care™ for the Cisco Aironet 3800i Access Point with internal antennas** |  - CON-SNT-AIRPIBK9: SNTC-8X5XNBD 802.11ac Ctrlr AP 4x Duration: 12 Month(s) |
| **Cisco Smart Net Total Care for the Cisco Aironet 3800e Access Point with external antennas** |  - CON-SNT-AIRPID38E: SNTC-8X5XNBD 802.11ac Ctrlr AP 4x4:3SS w/ CleanAir; Ex Duration: 12 Month(s) |
| **Cisco Smart Net Total Care for the Cisco Aironet 3800p Access Point with external antennas** |  - CON-SNT-AIRAP382: SNTC-8X5XNBD 802.11ac Ctrlr AP 4x Duration: 12 Month(s) |
| **Regulatory domains: (x = regulatory domain)** | Customers are responsible for verifying approval for use in their individual countries. To verify approval, and to identify the regulatory domain that corresponds to a particular country, visit [https://www.cisco.com/go/aironet/compliance](https://www.cisco.com/go/aironet/compliance). Not all regulatory domains have been approved. As they are approved, the part numbers will be available on the Global Price List. |
| **Cisco Smart Net Total Care Service:** | [https://www.cisco.com/go/sntc](https://www.cisco.com/go/sntc) |
  - AS-WLAN-CNSLT: [Cisco Wireless LAN 802.11n Migration Service](https://www.cisco.com/go/wlan-migration)  
| **Software and supported wireless LAN controllers** |  - Cisco Unified Wireless Network Software Release 8.2.111.0 or later  
  - Cisco IOS® XE Software Release 16.3  
  - Cisco Catalyst 3850 Series and 3650 Series Switches  
  - Cisco Mobility Express |
| **802.11n version 2.0 (and related) capabilities** |  - 4x4 MIMO with three spatial streams  
  - Maximal Ratio Combining (MRC)  
  - 802.11n and 802.11a/g beamforming  
  - 20- and 40-MHz channels  
  - PHY data rates up to 4.5 Gbps (40 MHz with 5 GHz)  
  - Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)  
  - 802.11 Dynamic Frequency Selection (DFS)  
  - Cyclic Shift Diversity (CSD) support |
| **802.11ac Wave 1 capabilities** |  - 4x4 MIMO with three spatial streams  
  - MRC  
  - 802.11ac beamforming  
  - 20-, 40-, and 80-MHz channels  
  - PHY data rates up to 1.3 Gbps (80 MHz in 5 GHz)  
  - Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)  
  - 802.11 DFS |
<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
</table>
| **802.11ac Wave 2 capabilities**            | ● 4x4 MU-MIMO with three spatial streams  
● MRC  
● 802.11ac beamforming  
● 20-, 40-, 80-, 160-MHz channels  
● PHY data rates up to 5.2 Gbps  
● Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)  
● 802.11 DFS  
● CSD support                                                                                  |
| **Wi-Fi Alliance Certified**                 | ● Wi-Fi Certified a, b, g, n, ac  
● Wi-Fi Certified a, b, g, n, ac  
● Wi-Fi Vantage  
● WMM  
● Passpoint                                                                                      |
| **Integrated antenna**                       | **Flexible radio (either 2.4 GHz or 5 GHz)**  
● 2.4 GHz, gain 4 dBi, internal antenna, omnidirectional in azimuth  
● 5 GHz, gain 6 dBi, internal directional antenna, elevation plane beamwidth 90°  
**Dedicated 5-GHz radio**                      |  
● 5 GHz, gain 5 dBi, internal antenna, omnidirectional in azimuth |
| **External antenna**                        | ● 3802e Series access points are certified for use with antenna gains up to 6 dBi (2.4 GHz and 5 GHz)  
● 3802p Series access points are certified for use with antenna gains up to 13 dBi (2.4 GHz and 5 GHz) with the [AIR-ANT2513-P4M-N=](#) antenna  
● Cisco offers the industry's broadest selection of antennas, delivering optimal coverage for a variety of deployment scenarios |
| **Smart Antenna Connector**                 | ● Available on the 3802e Series and 3802p Series access points only  
● Requires the AIR-CAB002-DART-R= 2 ft smart antenna connector to RP-TNC connectors to connect a second antenna to the access point  
● Required when running the flexible radio as either a:  
  ◦ Second 5-GHz serving radio  
  ◦ Wireless Security Monitoring radio |
### Interfaces
- 2 Ethernet ports
- 100/1000/2500/5000 Multigigabit Ethernet (RJ-45) – IEEE 802.3bz
  - CAT 5e cabling
  - Higher-quality 10GBASE-T (CAT 6/6a) cabling
- 100/1000BASE-T autosensing (RJ-45 - AUX port)
- Management console port (RJ-45)

### Indicators
- Status LED indicates boot loader status, association status, operating status, boot loader warnings, boot loader errors

### Dimensions (W x L x H)
- Access point (without mounting brackets): 3802i: 8.66 x 8.68 x 2.46 in. (22 x 22 x 6.25 cm), 3802E: 8.66 x 8.68 x 2.62 in. (22 x 22 x 6.7 cm), 3802P: 8.66 x 8.68 x 2.62 in. (22 x 22 x 6.7 cm)

### Weight
- 4.6 lb (2.09 kg)

### Input power requirements
- 802.3at PoE+, Cisco Universal Power over Ethernet (Cisco UPOE®)
- 802.3at power injector (AIR-PWRINJ6=)
- 50W power supply (AIR-PWR-50=)

### Power draw
- 25.8W at the PSE (22.5W at the PD) with all features enabled except for the USB 2.0 port
- 30W at the PSE (25.5W at the PD) with the USB 2.0 port enabled

### Environmental

#### Cisco Aironet 3800i
- Nonoperating (storage) temperature: -22° to 158°F (-30° to 70°C)
- Nonoperating (storage) altitude test: 25°C, 15,000 ft.
- Operating temperature: 32° to 104°F (0° to 40°C)
- Operating humidity: 10% to 90% percent (noncondensing)
- Operating altitude test: 40˚C, 9843 ft.

#### Cisco Aironet 3800e
- Nonoperating (storage) temperature: -22° to 158°F (-30° to 70°C)
- Nonoperating (storage) altitude test: 25°C, 15,000 ft.
- Operating temperature: -4° to 122°F (-20° to 50°C)
- Operating humidity: 10% to 90% (noncondensing)
- Operating altitude test: 40˚C, 9843 ft.

#### Cisco Aironet 3800p
- Nonoperating (storage) temperature: -22° to 158°F (-30° to 70°C)
- Nonoperating (storage) altitude test: 25°C, 15,000 ft.
- Operating temperature: -4° to 122°F (-20° to 50°C)
- Operating humidity: 10% to 90% (noncondensing)
- Operating altitude test: 40˚C, 9843 ft.

### System memory
- 1024 MB DRAM
- 256 MB flash

### Available transmit power settings

#### 2.4 GHz
- 23 dBm (200 mW)
- 20 dBm (100 mW)
- 17 dBm (50 mW)
- 14 dBm (25 mW)
- 11 dBm (12.5 mW)
- 8 dBm (6.25 mW)
- 5 dBm (3.13 mW)
- 2 dBm (1.56 mW)

#### 5 GHz
- 23 dBm (200 mW)
- 20 dBm (100 mW)
- 17 dBm (50 mW)
- 14 dBm (25 mW)
- 11 dBm (12.5 mW)
- 8 dBm (6.25 mW)
- 5 dBm (3.13 mW)
- 2 dBm (1.56 mW)
<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Frequency band and 20-MHz operating channels</td>
<td></td>
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<tr>
<td>A (A regulatory domain):</td>
<td>● 2.412 to 2.462 GHz; 11 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.180 to 5.330 GHz; 8 channels</td>
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<tr>
<td></td>
<td>● 5.500 to 5.700 GHz; 8 channels (excludes 5.600 to 5.640 GHz)</td>
</tr>
<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>B (B regulatory domain):</td>
<td>● 2.412 to 2.462 GHz; 11 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.500 to 5.720 GHz; 12 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>C (C regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>D (D regulatory domain):</td>
<td>● 2.412 to 2.462 GHz; 11 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>E (E regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<tr>
<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.500 to 5.700 GHz; 8 channels (excludes 5.600 to 5.640 GHz)</td>
</tr>
<tr>
<td>F (F regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.745 to 5.805 GHz; 4 channels</td>
</tr>
<tr>
<td>G (G regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>H (H regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.150 to 5.320 GHz; 8 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>I (I regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<tr>
<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<tr>
<td>K (K regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<tr>
<td></td>
<td>● 5.500 to 5.620 GHz; 7 channels</td>
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<td></td>
<td>● 5.745 to 5.805 GHz; 4 channels</td>
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<td>N (N regulatory domain):</td>
<td>● 2.412 to 2.462 GHz; 11 channels</td>
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<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
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<td>Q (Q regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<tr>
<td></td>
<td>● 5.500 to 5.700 GHz; 11 channels</td>
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<td>R (R regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<td></td>
<td>● 5.660 to 5.700 GHz; 3 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.745 to 5.805 GHz; 4 channels</td>
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<td>S (S regulatory domain):</td>
<td>● 2.412 to 2.472 GHz; 13 channels</td>
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<tr>
<td></td>
<td>● 5.180 to 5.320 GHz; 8 channels</td>
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<tr>
<td></td>
<td>● 5.500 to 5.700 GHz; 11 channels</td>
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<tr>
<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
</tr>
<tr>
<td>T (T regulatory domain):</td>
<td>● 2.412 to 2.462 GHz; 11 channels</td>
</tr>
<tr>
<td></td>
<td>● 5.180 to 5.320 GHz; 3 channels</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>● 5.745 to 5.825 GHz; 5 channels</td>
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<td>Z (Z regulatory domain):</td>
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<td>Maximum number of nonoverlapping channels</td>
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<tr>
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<td>● 802.11b/g:</td>
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<td></td>
<td>◦ 20 MHz: 3</td>
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<td></td>
<td>● 802.11n:</td>
</tr>
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<td></td>
<td>◦ 20 MHz: 3</td>
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<td></td>
<td><strong>5 GHz</strong></td>
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<td>● 802.11a:</td>
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<td>◦ 20 MHz: 25 FCC, 16 EU</td>
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<td>● 802.11n:</td>
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<td></td>
<td>◦ 20 MHz: 25 FCC, 16 EU</td>
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<tr>
<td></td>
<td>◦ 40 MHz: 12 FCC, 7 EU</td>
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<td></td>
<td>● 802.11ac:</td>
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<td></td>
<td>◦ 20 MHz: 25 FCC, 16 EU</td>
</tr>
<tr>
<td></td>
<td>◦ 40 MHz: 12 FCC, 7 EU</td>
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<tr>
<td></td>
<td>◦ 80 MHz: 6 FCC, 3 EU</td>
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<td>◦ 160 MHz 2 FCC, 1 EU</td>
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<td><strong>Note:</strong></td>
<td>This varies by regulatory domain. Refer to the product documentation for specific details for each regulatory domain.</td>
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<tr>
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<td>● EN 60950-1</td>
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<td>● EN 50155 for 3800e (Operating temperature -20° to 50°C)</td>
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<td>◦ FCC Part 15.107, 15.109, 15.247, 15.407, 14-30</td>
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<td>◦ EN 300.328, EN 301.893 (Europe)</td>
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<td>◦ ARIB-STD 66 (Japan)</td>
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<td>◦ ARIB-STD T71 (Japan)</td>
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<td>◦ EMI and susceptibility (Class B)</td>
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<td>◦ VCCI (Japan)</td>
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<td>◦ EN 301.489-1 and -17 (Europe)</td>
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<td>◦ EN 60601-1-2 EMC requirements for the Medical Directive 93/42/EEC</td>
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<td>◦ Advanced Encryption Standards (AES), Temporal Key Integrity Protocol (TKIP)</td>
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<td>◦ EAP-Transport Layer Security (TLS)</td>
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<td>◦ EAP-Tunneled TLS (TTLS) or Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAPv2)</td>
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<td>◦ Protected EAP (PEAP) vo or EAP-MSCHAPv2</td>
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<td>◦ EAP-Flexible Authentication via Secure Tunneling (FAST)</td>
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<td>◦ PEAP-v2 or EAP-Generic Token Card (GTC)</td>
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<td>◦ EAP-Subscriber Identity Module (SIM)</td>
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<td>● Multimedia:</td>
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| Data rates supported | 802.11b: 1, 2, 5.5, and 11 Mbps  
802.11a/g: 6, 9, 12, 18, 24, 36, 48, and 54 Mbps  
802.11n HT20: 6.5 to 216.7 Mbps (MCS0 to MCS23)  
802.11n HT40: 13.5 to 450 Mbps (MCS0 to MCS23)  
802.11ac VHT20: 6.5 to 288.9 Mbps (MCS0 to 8 – SS 1, MCS0 to 9 – SS 2 and 3)  
802.11ac VHT40: 13.5 to 600 Mbps (MCS0 to 9 – SS 1 to 3)  
802.11ac VHT80: 29.3 to 1300 Mbps (MCS0 to 9 – SS 1 to 3)  
802.11ac VHT160: 58.5 to 2304 Mbps (MCS0 to 9 – SS 1 and 2, MCS0 to 8 – SS 3) |

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2.4 GHz Azimuth Macro

2.4 GHz Elevation Macro
Warranty Information

The Cisco Aironet 3800 Series Access Points come with a limited lifetime warranty that provides full warranty coverage of the hardware for as long as the original end user continues to own or use the product. The warranty includes 10-day advance hardware replacement and ensures that software media are defect-free for 90 days. For more details, visit https://www.cisco.com/go/warranty.

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Introduction

These mounting instructions describe the steps for mounting supported Cisco Aironet series access points in several configurations, including on a suspended ceiling, on a hard ceiling or wall, on an electrical or network box, and above a suspended ceiling.

Mounting Hardware

Mounting hardware for access points consists of brackets, which connect to the bottom of the access point, and ceiling grid clips, which connect the bracket to a suspended ceiling. The bracket that you need depends on the mounting location for the access point. The ceiling grid clip that you need depends on the type of suspended ceiling where you need to install the access point. You don’t need ceiling grid clips if you are mounting the access point to a hard-surface ceiling or a wall.
Mounting Brackets

Two mounting brackets are available:

- The low-profile bracket (AIR-AP-BRACKET-1), which provides a tight fit between the access point and the ceiling but does not accommodate network/electrical box or wall mounting. Figure 1 shows the low-profile bracket installed on an access point.

- The universal bracket (AIR-AP-BRACKET-2), which is versatile (it works with electrical boxes, can be used for wall mounting, and adapts to ceiling installations) but leaves a larger gap between the mounting surface and the access point than the low-profile bracket. The larger gap is necessary in some locations because it allows space for cable routing. Figure 2 shows the universal bracket installed on an access point.

Note

The AP1130 ships with a specialized bracket. The information presented here on brackets does not apply to the AP1130.

Figure 1  Low-Profile Mounting Bracket Installed on an Access Point
Ceiling Grid Clips

You use a ceiling grid clip to mount an access point on a suspended ceiling. The ceiling grid clip that you need depends on the ceiling tiles on your ceiling. There are two types of ceiling grid clips:

- Ceiling Grid Clip, Recessed (AIR-AP-T-RAIL-R)—If your ceiling tiles hang below the ceiling grid, this clip provides the best fit between the AP and the ceiling.

- Ceiling Grid Clip, Flush (AIR-AP-T-RAIL-F)—If your ceiling tiles are flush with the ceiling grid, this clip provides a snug fit between the AP and the ceiling.

Figure 3 shows a ceiling grid clip.
Additional Adapters for Channel and Beam Ceiling Rails

The most common type of ceiling rail (the supports for the ceiling tiles) is the T-rail. You can attach a ceiling grid clip directly to a T-rail ceiling rail. However, other types of ceiling rails, such as channel rails and beam rails, require an additional adapter clip (AIR-CHNL-ADAPTER). You need two adapter clips for each access point. Setscrews on the clips hold them securely on the ceiling rail.

Figure 4 shows the three types of ceiling rails: T-rail, channel, and beam. Figure 5 shows an access point installed with mounting bracket, ceiling grid clip, and adapter clips.

<table>
<thead>
<tr>
<th>1</th>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>T-rail width detents (A, B, or C)</td>
</tr>
</tbody>
</table>

Figure 4 T-Rail, Channel, and Beam Ceiling Rail Types

Figure 5 Adapter Clips Installed with Ceiling Grid Clips
Mounting an Access Point Below a Suspended Ceiling

Follow these steps to mount the access point below a standard or recessed suspended ceiling. Figure 6 shows an access point mounted on a T-rail ceiling rail using a ceiling grid clip.

Figure 6  Suspended Ceiling Mounting Details

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Access point mounting keyhole</td>
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<tr>
<td>2</td>
<td>Ceiling grid clip</td>
</tr>
<tr>
<td>3</td>
<td>Grounding point</td>
</tr>
<tr>
<td>4</td>
<td>Access point cable access cover</td>
</tr>
<tr>
<td>5</td>
<td>Ceiling T-rail</td>
</tr>
</tbody>
</table>

Follow these steps to mount the access point below a suspended ceiling.

**Step 1**  Decide where you want to mount the access point on your suspended ceiling.

**Step 2**  Open the ceiling grid clip completely.

**Step 3**  Place the ceiling grid clip over the T-rail and close it to the appropriate detent (A, B, or C).

**Step 4**  Use a screwdriver to tighten the two ceiling grid clip locking screws to prevent the clip from sliding along the T-rail.

**Step 5**  Observe the ceiling grid clip width detent letter (A, B, or C) that corresponds to the T-rail width.

**Step 6**  Align the corresponding holes (A, B, or C) on the mounting bracket over the mounting holes on the ceiling grid clip.

**Step 7**  Hold the mounting bracket and insert a 6-32 x 1/4 in. screw into each of the four corresponding holes (A, B, or C) and tighten.

**Step 8**  If necessary, drill or cut a cable access hole in the ceiling tile large enough for the Ethernet and power cables. Pull the cables through the access hole until you have about 1 foot of cable protruding from the hole.
Mounting an Access Point on a Hard Ceiling or a Wall

This procedure describes the steps required to mount the access point on a ceiling constructed of 3/4-in (19.05-mm) or thicker plywood using #8 fasteners using the universal mounting bracket (AIR-AP-BRACKET-2).

Note
Access points with integrated antennas perform best when the access point is mounted on horizontal surfaces such as a table top or ceiling. For advanced features such as voice, location, and rogue access point detection, ceiling mounting is strongly recommended. However, for smaller areas such as conference rooms, kiosks, transportation environments, or hot-spot usage where data coverage is the primary concern, the unit may be wall mounted using wall anchors or screws.

Follow these steps to mount the access point on a solid ceiling or wall.

Step 1 Use the mounting bracket as a template to mark the locations of the mounting holes on the bracket. Figure 7 shows details of the mounting bracket.

Caution
Be sure to mark all four locations. To ensure a safe and secure installation, make sure you are using adequate fasteners and mount the access point using no less than four fasteners.

Caution
Do not use plastic wall anchors or the keyhole slots on the mounting bracket for ceiling installations. When mounting the access point on a hard ceiling, use four fasteners capable of maintaining a minimum pullout force of 20 lbs (9 kg).
Mounting an Access Point on a Hard Ceiling or a Wall

**Step 2**

Use a #29 drill (0.1360-in. [3.4772 mm]) bit to drill a pilot hole at the mounting hole locations you marked.

**Note**

The pilot hole size varies according to the material and thickness you are fastening. Cisco recommends that you test the material to determine the ideal hole size for your mounting application.

**Step 3**

(Optional) Drill or cut a cable access hole near and below the location of the mounting bracket cable access cover large enough for the Ethernet cable, building ground wire, and power cables.
Step 4  Pull approximately 9 inches of cable through the hole. Route the Ethernet and power cables through the bracket before you attach the bracket to the ceiling or wall. Route the cables through the main cable access hole and then through the smaller access hole as shown in Figure 8.

Figure 8  Routing the Ethernet and Power Cables

Step 5  (Optional) Use the ground screw to attach the building ground wire to the mounting bracket. See the “Grounding an Access Point” section on page 10 for general grounding instructions.

Step 6  Position the mounting bracket mounting holes (with indents down) over the pilot holes.

Step 7  Insert a fastener into each mounting hole and tighten.

Step 8  Connect the Ethernet and power cables to the access point.

Step 9  Align the access point feet with the large part of the keyhole mounting slots on the mounting plate. When positioned correctly, the cable access cover will fit inside the access point connector bay.

Step 10  Gently slide the access point onto the mounting bracket keyhole slots until it clicks into place.

Mounting an Access Point to a Network or Electrical Box

Follow these steps to mount an access point to a network box or an electrical box.

Step 1  Position the universal mounting bracket (AIR-AP-BRACKET-2) over the existing network or electrical box and align the bracket mounting holes with the box holes.

Step 2  Hold the mounting bracket in place and insert a 6 x 32 x 1/4-in pan head screw into each of the mounting holes and tighten.

Step 3  Pull approximately 9 inches of Ethernet and power cable through the hole. Route the cables through the bracket before you attach the bracket to the ceiling. Route the cables through the main cable access hole and then through the smaller access hole as shown in Figure 8.
Step 4  (Optional) Use the ground screw to attach the building ground wire to the mounting bracket. See the “Grounding an Access Point” section on page 10 for general grounding instructions.

Step 5  Connect the Ethernet and power cables to the access point.

Step 6  Align the access point feet over the keyhole mounting slots on the optional mounting bracket.

Step 7  Slide the access point onto the optional mounting bracket until it clicks into place.

Mounting an Access Point Above a Suspended Ceiling

Using third-party accessories (not offered by Cisco) you can mount an access point above a suspended ceiling. The universal mounting bracket (AIR-AP-BRACKET-2) supports a T-bar box hanger such as the Erico Caddy 512A or the Cooper B-Line BA50A. The box hanger should be oriented just above the top surface of a ceiling tile. If your ceiling uses particularly thick tiles, you might need to modify the tile to allow room for the access point or use a box hanger that allows you to adjust the height of the access point, such as the Cooper B-Line BA50A.

Note: Install access points above ceiling tiles only when mounting below the ceiling is not an option. Mounting access points above the ceiling can interfere with advanced wireless LAN features that depend on uniform coverage, such as voice and location.

Follow these steps to mount the access point above a suspended ceiling. Figure 9 shows the completed installation.

Figure 9  T-Bar Grid Mounting Bracket Parts

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<td>3</td>
<td>Box hanger clip</td>
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<tr>
<td>4</td>
<td>Mounting bracket</td>
</tr>
<tr>
<td>5</td>
<td>Access point</td>
</tr>
<tr>
<td>6</td>
<td>T-rail clip</td>
</tr>
</tbody>
</table>

Step 1  Remove a ceiling tile adjacent to the mounting location.

Step 2  Fasten the access point mounting bracket to the box hanger using the clip or screws provided with the box hanger kit.
Grounding an Access Point

Grounding is not always required for indoor installations because Cisco Aironet access points are classified as low-voltage devices and do not contain internal power supplies. We recommend that you check your local and national electrical codes to see if grounding is a requirement.

Although grounding is not mandatory for indoor access points, it is required in certain scenarios. It has been observed that an ungrounded indoor access point that is mounted too close to an electromagnetic source of interference (such as a fluorescent light that is on) may reboot suddenly or suffer hardware damage. This occurs even if the indoor AP is in close proximity to the electromagnetic source of interference, and not touching the source. Grounding the corresponding access point or the mounting bracket helps prevent this issue from occurring. We recommend that a certified electrical technician verify whether your installation requires grounding.

If grounding is required in your area or you wish to ground your access point, follow these steps.

Step 1 Find a suitable building grounding point as close to the access point as possible.
Step 2 Connect a user-supplied ground wire to the building grounding point. The wire should be a minimum of #14AWG assuming a circuit length of 25 ft (30.5 cm). Consult your local electrical codes for additional information.
Step 3 Route the ground wire to the access point.
Step 4 Attach the wire to a suitable grounding O-ring lug.
Step 5 Crimp or solder the wire to the lug.
Step 6 Insert the grounding post screw into the O-ring lug and install it on the mounting bracket as shown in Figure 10.
Step 7  Use a Phillips screwdriver to tighten the ground screw.
Securing an Access Point

There are two ways to secure your access point:

- Attach it to an immovable object with a security cable.
- Lock it to the mounting plate with a padlock.

Using a Security Cable

You can secure the access point by installing a standard security cable (such as the Kensington Notebook MicroSaver, model number 64068) into the access point security cable slot as shown in Figure 11.

![Security Cable Details](image)

The security cable can be used with any of the mounting methods described in this guide.

Follow these steps to install the security cable.

<table>
<thead>
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<th>Step</th>
<th>Description</th>
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<tbody>
<tr>
<td>Step 1</td>
<td>Loop the security cable around a nearby immovable object.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Insert the key into the security cable lock.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Insert the security cable latch into the security cable slot on the access point.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Rotate the key right or left to secure the security cable lock to the access point.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Remove the key.</td>
</tr>
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</table>
Securing an Access Point

Securing the Access Point to the Mounting Plate

Use the security hasp on the adapter cable access cover and a padlock (that you provide) to secure your access point to the mounting plate. Compatible padlocks are Master Lock models 120T or 121T. The cable access cover on the mounting bracket covers the cable bay area (including the power port, Ethernet port, console port, and the mode button) to prevent the installation or removal of the cables or the activation of the mode button.

Follow these instructions to install the padlock:

**Step 1**
With the access point installed on the mounting bracket, insert a padlock into the security hasp.

---

**Note**
If your access point is mounted to a hard ceiling, the clearance between the mounting bracket and the ceiling is small. Work slowly using both hands to position and secure the lock into the mounting bracket hasp.

**Step 2**
Rotate the lock clockwise and align the bail with the lock body.

**Step 3**
Grasp the lock and push it into the bail to lock the lock. See **Figure 12**.

**Figure 12** Inserting the Padlock into the Security Hasp

**Step 4**
Rotate the padlock into the padlock area. See **Figure 13**.

**Figure 13** Rotating the Padlock into the Padlock Area
Obtaining Documentation and Submitting a Service Request

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BID/PRICE PROPOSAL FORM

BIDDER’S NAME: 

PROJECT TITLE: CFA & ES Wireless Upgrade

PROJECT NUMBER: TU-1982-SBR

Failure to properly complete each blank may be cause for rejection of this proposal.

Having carefully examined all of the solicitation documents for the above referenced project and ADDENDA NUMBER(S) being collectively referred to as the Contract Documents, and having received clarification on all items of conflict or upon which any doubt arose, the undersigned proposes to furnish all labor, materials and equipment required by the said documents for the entire work, all in strict accordance with the Contract Documents, for the sum of:

TOTAL COST OF PROJECT

BASE BID $ 

If the undersigned is notified by the Procurement Officer/Representative of the acceptance of the bid within 90 days after the bid date, Contractor agrees to guarantee the completion of this work as specified in the Contract Documents.

Firm License Number (If Applicable) Date Issued Place of Issuance

Minority Business Enterprises:

The undersigned certifies that the Bidder:

_____ IS NOT a Certified Minority Business Enterprise.

_____ IS a Minority Business Enterprise (MBE), certified by the Maryland Department of Transportation, and assigned the following certification number: ___________________(Certification Number)
The undersigned affirms, and it is a condition precedent to acceptance of this bid, that the bidder has not been a party to any agreement to bid a fixed or uniform price.

Company Name: _______________________________________

Address: _____________________________________________

____________________________________________________________________

Phone/Fax No.: ___________________________________________

E-mail Address: ___________________________________________

Federal Tax ID Number: _________________________________

By: _____________________________________________________

Signature of Officer or Authorized Agent

____________________________________________________________________

Printed Name

____________________________________________________________________

Title

Witness: ________________________________________________
EXHIBIT F
COMPANY PROFILE

COMPANY NAME: ____________________________________________

DATE OF INCORPORATION: ___________ STATE OF INCORPORATION: ___________

TYPE OF WORK PERFORMED: ________________________________________________

__________________________________________________________________________

__________________________________________________________________________

NUMBER OF YEARS IN BUSINESS: ____________________________________________

OTHER OR FORMER NAMES UNDER WHICH YOUR ORGANIZATION HAS OPERATED:

__________________________________________________________________________

TYPE OR ORGANIZATION: (I.E., CORP., PARTNERSHIP, INDIVIDUAL, JOINT VENTURE, OTHER):

__________________________________________________________________________

NAME OF PRINCIPAL(S) AND TITLE(S): _______________________________________

__________________________________________________________________________

__________________________________________________________________________

BRIEF HISTORY OF COMPANY: ______________________________________________

__________________________________________________________________________

__________________________________________________________________________

TOTAL NUMBER OF EMPLOYEES: _____________________________________________

NUMBER OF FIELD EMPLOYEES (Excluding Supervisory): _______________________

NUMBER OF FIELD SUPERVISORY PERSONNEL: _________________________________

NUMBER OF OFFICE PERSONNEL (Excluding Supervisory): _______________________

NUMBER OF OFFICE SUPERVISORY PERSONNEL: _________________________________

BONDING CO.: ___________________ BONDING CAPACITY: ______________________
EXHIBIT G
FIRM EXPERIENCE

Duplicate as necessary to provide all required experience.

PROPOSER: ____________________________

PROJECT NAME: ____________________________

PROJECT DOLLAR SIZE: ____________________________

START DATE: ____________________________

COMPLETION DATE: ____________________________

CLIENT/CUSTOMER: ____________________________

ADDRESS: ____________________________

CONTACT PERSON: ____________________________

TELEPHONE NUMBER: ____________________________

FAX NUMBER: ____________________________

EMAIL: ____________________________

PROJECT MANAGER: ____________________________

BRIEF, BUT DETAILED DESCRIPTION OF THE PROJECT:

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

SIMILARITIES BETWEEN THIS PROJECT AND TU PROJECT:

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
EXHIBIT K
ADDENDA ACKNOWLEDGMENT

NAME OF BIDDER: _______________________________

SOLICITATION NUMBER: _______________________________

PROJECT TITLE: _______________________________

DUE DATE: _______________________________

ACKNOWLEDGMENT

I hereby acknowledge receipt of the following addenda which have been issued regarding the above referenced solicitation:

  Addendum #1, issue date __________________________
  Addendum #2, issue date __________________________
  Addendum #3, issue date __________________________
  Addendum #4, issue date __________________________
  Addendum #5, issue date __________________________
  Addendum #6, issue date __________________________

____________________________  ____________________________
Signature                        Printed Name

____________________________
Title

____________________________
Date                        Company
This Addendum sets forth the mandatory terms and conditions required by Towson University and the Procurement Policies and Procedures of the University System of Maryland that by this Addendum are included in the contract attached. The Contractor agrees that the University's acceptance of and payment for the goods and/or services under this contract are conditioned upon the inclusion of the terms and conditions set forth below.

.01 Incorporation by Reference. All terms and conditions of the solicitation, and any amendments thereto, are made a part of this contract.

.02 Tax Exemption. The State is generally exempt from federal excise taxes, Maryland sales and use taxes District of Columbia sales taxes, and transportation taxes. Exemption certificates shall be completed upon request. Where a Contractor is required to furnish and install material in the construction or improvement of real property in performance of a contract, the Contractor shall pay the Maryland Sales Tax and the exemption does not apply.

.03 Scope of Work. The Contractor shall furnish all labor, and all materials, equipment, supplies or services in order to complete the total work in accordance with the specifications, federal and State laws and regulations.

.04 Delivery and Acceptance. Delivery shall be made in accordance with the instructions set forth in the contract documents and/or solicitation. The University, in its sole discretion, may extend the time of performance for excusable delays due to unforeseeable causes beyond the Contractor's control. The University unilaterally may order in writing the prompt replacement of materials lawfully rejected shall be liable for any excess price paid for the replacement, plus applicable expenses, if any.

.05 Non-Hiring of Employees. No employees of the State of Maryland or any department, commission, agency or branch thereof whose duties as such employee include matters relating to or affecting the subject matter of this contract shall, while so employed, become or be an employee of the party or parties hereby contracting with the State or any unit thereof.

.06 Nondiscrimination in Employment. The Contractor agrees not to discriminate in any manner against an employee or applicant for employment because of race, color, religion, creed, age, sex, marital status, national origin, ancestry, or physical or mental handicap unrelated in nature and extent so as reasonably to preclude the performance of such employment and to post and cause subcontractors to post in conspicuous places available to employees and applicants for employment, notices setting forth the substance of this clause. Towson University's policies, programs, and activities comply with federal and state laws and University System of Maryland regulations prohibiting discrimination on the basis of race, color, religion, age, national origin, sex, disability, and sexual orientation.

.07 Financial Disclosure. The Contractor shall comply with the State Finance & Procurement Article, § 13-221, Annotated Code of Maryland, which requires that every business that enters into contracts, leases or other agreements with the State and receives in the aggregate $100,000 or more during a calendar year shall, within 30 days of the time when the $100,000 is reached, file with the Secretary of State certain specified information to include disclosure of beneficial ownership of the business.

.08 Political Contribution Disclosure. The Contractor shall comply with the provisions of the Election Law Article, § 14-101 et seq., Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State of Maryland or a political subdivision of the State, including its agencies, during a calendar year under which the person receives in the aggregate $100,000 or more, shall file with the Administrative Board of Election laws a statement disclosing contributions in excess of $500 made during the reporting period to a candidate for elective office in any primary or general election. The statement shall be filed with the State Administrative Board of Election Laws: (a) before a purchase or execution of a lease or contract by the University, a county, an incorporated municipality or their agencies, and shall cover the preceding two calendar years; and (b) if the contribution is made after the execution of a lease or contract, then twice a year, throughout the contract term, on (1) February 5, to cover the six-month period ending January 31; and (2) on August 5, to cover the six-month period ending July 31.

.09 Anti-Bribery. The Contractor warrants that neither it nor any officer, director or partner, nor any employee involved in obtaining contracts with any public body has been convicted of bribery, attempted bribery or conspiracy to bribe, nor has engaged in conduct since July 1, 1977, which would constitute bribery, attempted bribery, or conspiracy to bribe under the laws of any state or the federal government.

.10 Registration. Pursuant to §§ 7-201 et seq. of the Corporations and Associations Article of the Annotated Code of Maryland, corporations not incorporated in the State shall be registered with the State Department of Assessments and Taxation, 301 West Preston St., Baltimore, Maryland 21201, before doing any interstate or foreign business in this State. Before doing any intrastate business in this State, a foreign corporation shall qualify with the Department of Assessments and Taxation.

.11 Contingent Fees. The Contractor warrants that it has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Contractor, to solicit or secure this agreement, and that it has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or any other consideration contingent on the making of this agreement.

.12 EPA Compliance. Materials, supplies, equipment, or services shall comply in all respects with the Federal Noise Control Act of 1972, where applicable.

.13 Occupational Safety and Health Act (O.S.H.A.). All materials, supplies, equipment, or services supplied as a result of this contract shall comply with the applicable U.S. and Maryland Occupational Safety and Health Act standards.

.14 Termination for Convenience. Upon written notice to the Contractor, the University may terminate this contract, in whole or in part, whenever the University shall determine that such termination is
in the best interest of the University. The University shall pay all reasonable costs incurred up to the date of termination and all reasonable costs associated with termination of the contract. However, the Contractor may not be reimbursed for anticipatory profits. Termination hereunder, including the determination of rights and obligations of the parties, shall be governed by the provisions of the USM Procurement Policies and Procedures.

.15 Termination for Default. If the Contractor fails to fulfill its obligation under this contract properly and on time, or otherwise violates any provision of this contract, the University may withhold payment at the discretion of the University and/or terminate the contract by written notice to the Contractor. The notice shall specify the acts or omissions relied upon as cause for termination. All finished or unfinished work provided by the Contractor shall, at the University’s option, become the University’s property. The University shall pay the Contractor fair and equitable compensation for satisfactory performance prior to receipt of notice of termination, less the amount of damages caused by Contractor’s breach. If the damages are more than the compensation payable to the Contractor, the Contractor will remain liable after termination and the University can affirmatively collect damages. Termination hereunder, including the determination of the rights and obligations of the parties, shall be governed by the provisions of the USM Procurement Policies and Procedures.

.16 Disputes. This contract shall be subject to USM Procurement Policies and Procedures. Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the contract in accordance with the procurement officer’s decision.

.17 Multi-Year Contracts. If the General Assembly fails to appropriate funds or if funds are not otherwise made available for continued performance for any fiscal period of this contract succeeding the first fiscal period, this contract shall be canceled automatically as of the beginning of the fiscal year for which funds were not appropriated or otherwise made available; provided, however, that this will not affect either the University’s rights or the Contractor’s rights under any termination clause in this contract. The effect of termination of the contract hereunder will be to discharge both the Contractor and the University from future performance of the contract, but not from their rights and obligations existing at the time of termination. The Contractor shall be reimbursed for the reasonable value of any non-recurring costs incurred but not amortized in the price of the contract. The Contractor may not recover anticipatory profits or costs incurred after termination. The University shall notify the Contractor as soon as it has knowledge that funds may not be available for the continuation of this contract for each succeeding fiscal period beyond the first.

.18 Intellectual Property. Contractor agrees to indemnify and save harmless the University, its officers, agents and employees with respect to any claim, action, cost or judgment for patent infringement, or trademark or copyright violation arising out of purchase or use of materials, supplies, equipment or services covered by this contract.

.19 Maryland Law Prevalis. The provisions of this contract shall be governed by the laws of Maryland.

.20 Contractor’s Invoices. Contractor agrees to include, on the face of all invoices billed to the University, its Taxpayer Identification Number which is the Social Security Number for individuals and sole proprietors and the Federal Employer Identification Number for all other types of organizations. If a Purchase Order document is used, the Purchase Order Number must be included.

.21 Pre-existing Regulations. The regulations set forth in USMProcurement Policies and Procedures in effect on the date of execution of this Contractor are applicable to this Contract.

.22 Indemnification. The University shall not assume any obligation to indemnify, hold harmless, or pay attorney’s fees that may arise from or in any way be associated with the performance or operation of this contract.

.23 Conflicting Terms. Any proposal for terms in addition to or different from those set forth in this purchase order or contract or any attempt by the Contractor to vary any of the terms of its offer by Contractor’s acceptance shall not operate as a rejection of this offer, unless such variance is in the terms of the description, quantity, price or delivery schedule, but shall be deemed a material alteration thereof, and this offer shall be deemed acceptable by the Contractor without the additional or different terms. If this purchase order is an acceptance of a prior offer by the Contractor, the acceptance is expressly conditioned upon Contractor’s assent to any additional or different terms contained herein. The Contractor understands and agrees that the terms and conditions of this purchase order may not be waived.

.24 Drug and Alcohol Free Workplace. The Contractor warrants that the Contractor shall comply with COMAR 21.11.08 Drug and Alcohol Free Workplace, and that the Contractor shall remain in compliance throughout the term of the purchase order or contract.

.25 Retention of Records. The Contractor shall retain and maintain all records and documents relating to this contract for three years after final payment by the State to the Contractor. The Contractor shall establish and maintain appropriate records to support discharge of responsibilities as required by Maryland, or any department or unit thereof, including but not limited to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of either the Contractor or the subcontractors or suppliers.

.26 Delays and Extensions of Time. The Contractor agrees to prosecute the work continuously and diligently and no charges or claims for damages shall be made by it for any delays or hindrances from any cause whatsoever during the progress of any portion of the work specified in this Contract. Time extensions will be granted only for excusable delays that arise from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of either the Contractor or the subcontractors or suppliers.

.27 Modifications. This contract may be amended with the consent of both parties. Amendments may not significantly change the scope of the contract.

.28 Suspension of Work. The procurement officer unilaterally may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work for such period of time as she/he may determine to be appropriate for the convenience of the University.

.29 Compliance with Laws. The Contractor hereby represents and warrants that: (a) it is qualified to do business in the State of Maryland and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified; (b) it is not in arrears with respect to the payment of any moneys due and owing the State of Maryland, or any department or unit thereof, including but not limited to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of either the Contractor or the subcontractors or suppliers.
ordinances applicable to its activities and obligations, under this Contract; and (d) it shall obtain, at its expense, all licenses, permits, insurance, and governmental approvals, if any, necessary to the performance of its obligations under this Contract.

.30 Payment of State Obligations. Payments to the Contractor pursuant to this contract shall be made no later than 30 days after the State's receipt of a proper invoice from the Contractor. Charges for late payment of invoices, other than as prescribed by Title 15, Subtitle 1, of the State Finance and Procurement Article, Annotated Code of Maryland, or by the Public Service Commission of Maryland with respect to regulated public entities, as applicable, are prohibited.

.31 Software Contracts. As specifically provided by § 21-104, Commercial Law Article, Annotated Code of Maryland, the parties agree that this contract shall not be governed by the Uniform Computer Information Transactions Act (UCITA), Title 21 of the Commercial Law Article of the Annotated Code of Maryland, as amended from time to time. This contract shall be governed by the common law of Maryland relating to written agreements, as well as other statutory provisions, other than UCITA, which may apply, and shall be interpreted and enforced as if UCITA had never been adopted in Maryland.

Contractor agrees that as delivered to buyer, the software does not contain any program code, virus, worm, trap door, back door, timer or clock that would erase data or programming or otherwise cause the software to become inoperable, inaccessible, or incapable of being used in accordance with its user manuals, either automatically upon the occurrence of selected conditions, or manually on command of Contractor.

.32 Gramm-Leach-Bliley Act of 1999 The Contractor agrees that in performing its obligations under this contract, the Contractor shall comply with all requirements of a non-affiliated third-party who receives a financial institution’s consumer or customer information, under the Gramm-Leach-Bliley Act of 1999 and applicable regulations thereto (the “GLB Act”), and other applicable federal and state consumer privacy acts, rules and regulations. Nonpublic personal information shall have the same meaning as that term is defined in the GLB Act.

a. The Contractor agrees to disclose such nonpublic personal information for the sole purpose of facilitating the Contractor’s performance of its duties and obligations under this contract and will not disclose such nonpublic personal information to any other party unless such disclosure is (i) allowed by the GLB Act and consented to by the Customer, or (ii) compelled by law, in which case the Contractor will provide notice of such disclosure to the Customer.

b. The Contractor represents and warrants that it will, for so long as it retains nonpublic personal information, implement and maintain in place the necessary information security policies and procedures for (i) protecting the confidentiality of such nonpublic person information, (ii) protecting against any anticipated threats or hazards to the security or integrity of such nonpublic personal information, and (iii) protecting against the unauthorized access to or use of such nonpublic personal information. These terms apply to all subcontractors employed by the Contractor who perform work under the scope of this agreement.

.33 I-9 Requirement Contractor warrants and represents that it is currently in compliance, and that during the term of this contract it will remain in compliance, with the Immigration Reform and Control Act of 1986, and that it will obtain original valid employment verification documentation from all its employees on a timely basis as required by law and regulation. This requirement also applies to all subcontractors hired by Contractor.

.34 Mandated Contractor Reporting of Suspected Child Abuse & Neglect. Maryland law contains mandatory reporting requirements for all individuals who suspect child abuse or neglect. Contractors performing work on campus also must comply with USM Board of Regents (BOR) VI-1.50 – Policy on the Reporting of Suspected Child Abuse & Neglect, as well as the University Procedures for Reporting Suspected Child Abuse and Neglect. The above-referenced USM/University Policy and Procedures are available in full at the following link: https://inside.towson.edu/generalcampus/tupolicies/documents/06-01.50%20Policy%20on%20the%20Reporting%20of%20Suspected%20Child%20Abuse%20and%20Neglect.pdf and are incorporated herein. The University reserves the right to terminate the contract if Contractor fails to comply with the above-referenced policy or procedures, or if, in the judgment of the University, termination is necessary to protect the safety and welfare of children who come into contact with the University community.

.35 Subcontracting or Assignment The benefits and obligations hereunder shall take effect and be binding upon the parties hereto and neither the contract nor the services to be performed thereunder shall be subcontracted, or assigned or otherwise disposed of, either in whole or in part, except with the prior written consent of the University.

.36 Responsibility for Claims and Liability The Contractor shall be responsible for all damage to life and property due to its activities or those of its agents or employees, in connection with the services required under the contract. Further, it is expressly understood that the Contractor shall indemnify and save harmless the University, its officers, agents, and employees from and against all claims, suits, judgments, expenses, actions, damages and costs of every name and description, including reasonable attorney’s fees and litigation expenses arising out of or resulting from the negligent performance of the services of the Contractor under the contract.

.37 Non-Visual Access Clause The Contractor warrants that the information technology offered under this bid or proposal (i) provides equivalent access for effective use by both visual and nonvisual means; (ii) will present information, including prompts used for interactive communications, in formats intended for both visual and nonvisual use; (iii) if intended for use in a network, can be integrated into networks for obtaining, retrieving, and disseminating information used by individuals who are not blind or visually impaired; and (iv) is available, whenever possible, without modification for compatibility with software and hardware for nonvisual access. The bidder or offeror further warrants that the costs, if any, of modifying the information technology for compatibility with software and hardware used for nonvisual access will not increase the cost of the information technology by more than 5 percent.

For purposes of this section, the phrase “equivalent access” means that the ability to receive, use and manipulate information and operate controls necessary to access and use information technology by nonvisual means. Examples of equivalent access include keyboard controls used for input and synthesized speech, Braille, or other audible or tactile means used for output.

.38 Confidentiality; Dissemination of Information Contractor shall not release any information related to services or performance of the services under this Contract, nor publish any final reports or documents without the prior written approval of the University. Contractor shall indemnify and hold harmless the State and the University, its officers, agents and employees from all harm which may be incurred by reason of dissemination, publication, distribution or circulation, in any manner whatsoever, of any information, data, documents, or materials pertaining in any way to
this Contract by Contractor, its agents or employees.

.39 Ownership of Documents and Materials
The Contractor agrees that all documents and materials including, but not limited to, reports, drawings, studies, specifications, estimates, maps, photographs, designs, graphics, mechanical, artwork, and computations prepared by or for it under the terms of the contract shall at any time during the performance of the services be made available to the University upon request by the University and shall become and remain the exclusive property of the University upon termination or completion of the services. The University shall have the right to use same without restriction or limitation and without compensation to the Contractor other than that provided by the contract. The University shall be the owner for purposes of copyright, patent or trademark registration.

.40 Family Educational Rights and Privacy Act (FERPA)
The Parties agree to maintain the privacy and security of personally identifiable educational records and health information and to prevent disclosure in compliance with Federal laws.