1 General

1.1 Scope of work

1.1.1 The work required under this section consists of providing telecommunications infrastructure for wireless access points along with associated equipment for a complete wireless network.

1.1.2 Some projects may exclude the purchase and/or installation of the Wireless Access Points (APs) and antennas.

1.2 Intent of Drawings and Specifications

1.2.1 These Specifications, together with the Drawings accompanying them, are intended to depict the installation requirements necessary to support this Project. Contractor shall furnish materials shown and/or called for in the Drawings but not mentioned in the Specifications, or vice versa, that are necessary for the installation and support of communications cabling, whether or not specifically called for in both. In addition, Contractor shall provide incidental equipment and materials required for the completion of systems included in this contract whether or not specified or shown on the Drawings.

1.3 Definitions

1.3.1 Data-Only PIC (Purdue Information Connection) - The telecommunications connection at the customer end consisting of (2) data jacks.

1.3.2 AP (Wireless Access Point) - A radio device that connects to antennas to facilitate communications that form a wireless network. The AP connects to a wired network, and relays data between wireless devices and wired devices.

1.3.3 Omni-directional - An antenna system which radiates power uniformly in one plane with a directive pattern shape in a perpendicular plane. This pattern is often described as "donut shaped".

1.3.4 Dipoles - An antenna with a center-fed driven element for transmitting or receiving radio frequency energy.

1.3.5 Directional antennas - An antenna which radiates greater power in one or more directions allowing for increased performance on transmit and receive and reduced interference from unwanted sources. Directional antennas like yagi antennas provide increased performance over dipole antennas when a greater concentration of radiation in a certain direction is desired.

1.3.6 Diversity wall mount bracket - A bracket specifically designed to aim a directional antenna toward a specific area. These brackets are made and supplied by the Owner.

1.3.7 Site Survey - The process of planning and designing a wireless network to provide a wireless solution that will deliver the required wireless coverage, data rates, network capacity, roaming capability and Quality of Service (QoS).

1.3.8 dB (Décibel) - A logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Its logarithmic nature allows very large or very small ratios to be represented by a convenient number, in a similar manner to scientific notation. Since it expresses a ratio of two (same unit) quantities, it is a dimensionless unit.

1.3.9 dBi (Décibel isotropic) - The forward gain of an antenna compared to the hypothetical isotropic antenna, which uniformly distributes energy in all directions.

1.3.10 PoE (Power over Ethernet/IEEE 802.3af or Power of Ethernet/IEEE 802.3at standard) - A system that transmits electrical power, along with data, to remote devices over standard twisted-pair cable in an Ethernet network. This technology is useful for powering WAPs and other appliances where it would be inconvenient, expensive or infeasible to supply power separately.

1.3.11 Mid-Span Power Injector - Power injectors that stand between a regular Ethernet switch and the powered device, injecting power without affecting the data. Mid-spans are only used when PoE capable Ethernet switches are not available in the telecommunications room.

1.3.12 IEEE 802.11a standard - Uses the same core protocol as the original standard (802.11), operates in 5 GHz band, and uses a 52-subcarrier orthogonal frequency-division multiplexing (OFDM) with a maximum raw data rate of 54 Mbit/s, which yields realistic net achievable throughput in the mid-20 Mbit/s.

1.3.13 IEEE 802.11b/g standard - Uses the same core protocol as the original standard (802.11), operates in 2.4 GHz band, and uses a 52-subcarrier orthogonal frequency-division multiplexing (OFDM) with a maximum raw data rate of 54 Mbit/s, which yields realistic net achievable throughput around 19 Mbit/s.

1.3.14 IEEE 802.11n standard - Uses the same core protocol as the original standard
This standard can operate in the 2.4GHz and 5GHz band by adding MIMO (Multiple-Input, Multiple Output) and 40MHz channels on the physical layer, and frame aggregation to the MAC layer. Uses (3) antennas per radio band.

1.3.15 IEEE 802.11ac standard – Uses the same core protocol as the original standard (802.11). This standard can operate in the 2.4GHz and 5GHz band by adding MIMO (Multiple-Input, Multiple Output) and 80MHz channels on the physical layer, and frame aggregation to the MAC layer. Uses (3) antennas per radio band.

1.3.16 ITIS – Purdue Information Technology Infrastructure Services. Governing body for Telecommunications Installations at the Purdue West Lafayette campus.

2 Products

Note: It is Purdue’s expectation that the A/E of Record will work jointly with Purdue’s Telecommunication representatives to address specific technical issues and Owner requirements. All questions, deviations, comments concerning guideline(s) interpretation, content, and/or use must be submitted in writing to the Project Manager for approval. No deviations from these guidelines shall be incorporated into the project without written approval from the Project Manager and Purdue Telecommunications representative.

2.1 Wireless Access Points (AP)

2.1.1 Provide (2) Category 6A cables at each Wireless Access Point location as shown on drawings, scope of work, or herein. See Section 27 15 13 for cabling requirements.

2.2 Wireless Access Point Antennas

2.2.1 Provide Wireless Access Point Antennas as shown on drawings, scope of work, or herein.

2.3 Wireless Access Point Enclosures

2.3.1 Provide Wireless Access Point Enclosures as shown on drawings, scope of work, or herein.

2.4 Patch cords

2.4.1 Cat 6A, 3ft purple plenum patch cord or Owner-approved equal.

2.5 Miscellaneous Hardware

2.5.1 Wiremold #2448-2 or Owner-approved equal, Ivory Box for below-ceiling installations

2.5.2 Top Mount T-Bar Fastener or Owner-approved equal

2.5.3 Panduit #LD3, Surface Raceway for managing antenna cables and jumpers through T-Grid

2.5.4 5” x 5” x 3 ¼” box with ½” double gang plaster ring for above ceiling installations

2.6 Labeling

2.6.1 Copper, Fiber, and Coax Horizontal Cable Labels

2.6.2 Panduit #S100X150VAC, 1.0” wide x 1.5” length, white vinyl label or Owner-approved equal.

2.6.3 Patch Panel Labels in TRs

2.6.4 Panduit #C061X030FJC, 0.61” wide x 0.30” height, one-port identifier or Owner-approved equal.

2.6.5 Faceplate Labels

2.6.6 Panduit #T038X000VPC-BK, 0.38” height, black lettering on white vinyl tape or Owner-approved equal.

3 Execution

3.1 General Requirements

3.1.1 Installation of Data-Only PICs

3.1.1.1 Locations shall be installed as shown on drawings. All proposed locations must be reviewed and approved by Purdue ITIS staff prior to installation. If location modifications are necessary, ITIS staff will provide direction.

3.1.1.2 New construction outlet box shall be a 4 11/16” H x 4 11/16” W x 3 ¼” D square flush mounted box. Boxes are to be installed with a double gang, square drawn extension or tile ring. Outlet box shall have a 1 ¼” EMT conduit to nearest distribution system or as indicated on the Drawings or as specified herein.

3.1.1.3 PICs above ceilings in existing construction and within 18”-24” of a skeletal opening or cable tray system will not require conduit, unless the PIC is on the other side of the wall from the distribution system.
3.1.1.4 PICs in existing construction and above ceilings further than 24” from a skeletal opening or cable tray system shall have 1 ¼” EMT installed from 4 11/16” H x 4 11/16” W x 3 ¼” D square box with double gang, square drawn extension or tile ring to within 18”-24” of skeletal openings or cable tray systems.

3.1.1.5 PICs in areas without a ceiling shall be installed 8’-0” (nominal) to 10’-0” (maximum) AFF. Any deviations must be approved by ITIS prior to installation.

3.1.1.6 PICs in areas with a ceiling lower than or equal to 10’-0” shall be installed above the ceiling. Any deviations must be approved by ITIS prior to installation.

3.1.1.7 PICs in areas with a ceiling higher than 10’-0” shall be installed 8’-0” (nominal) to 10’-0” (maximum). Any deviation must be approved by ITIS prior to installation.

3.1.1.8 Deviations from specified locations shall be submitted for approval prior to installation to the Purdue ITIS Department.

3.1.1.9 Data-only PICs shall be tested, verified, and approved prior to AP installation.

3.1.1.10 All PICs shall be installed so there is 1’-0” clearance in front of the faceplate for maintenance.

3.1.1.11 Label PIC as specified herein and in Section 27 05 53.

3.1.2 Installation of AP brackets

3.1.2.1 Installation of AP brackets shall commence by owner.

3.1.3 Installation of APs

3.1.3.1 APs shall be installed in corresponding PIC location.

3.1.3.2 Access points must be mounted at least 3’-0” away from any metal obstructions, as described in the installation of antenna section below.

3.1.3.3 Access points to be mounted 8’-0” (nominal) to 10’-0” (maximum) AFF, if ceiling is not present, or the ceiling exceeds 10’-0” in height. Any deviation must be approved by ITIS.

3.1.3.4 Access points to be mounted approximately 1’-0” above ceiling level, when grid is present. This allows for antenna movement and positioning, as well as, access to the AP unit.

3.1.3.5 Do not mount the access points on the building perimeter walls unless outside coverage is required on drawings or specified herein.

3.1.3.6 Access point to be installed with 1 plenum patch cords as required by the building. Patch cord shall run from the Ethernet port on the AP to the first jack in the number sequence on the PIC.

3.1.4 Installation of Antennas

3.1.4.1 Keep the antenna at least 24” away from metal obstructions such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs.

3.1.4.2 Orient the access point 2.4-GHz and 5-GHz antennas so that they are pointing downward when mounted horizontally. When vertically mounting access point utilizing dipole antennas, 2.4-GHz and 5-GHz dipolar antennas should be perpendicular to floor, regardless of AP orientation.

3.1.5 Installation of APs with Internal Antennas

3.1.5.1 Any AP with internal antennas must be mounted horizontally and pointed downwards.

3.1.5.2 Any AP with internal antennas should be mounted to the ceiling grid or trapeze as shown on drawings.

3.1.5.3 Any AP with internal antennas needs to be mounted at least 3’ away from any structural metal.
3.1.6 Installation of WAP Enclosures
3.1.7 Installation of data patch cords

3.1.6.1 Patch cords shall be plenum-rated violet Category 6A cables by approved Purdue cable manufacturers

3.2 Labeling For APs

3.2.1 Horizontal Cable Labeling:

3.2.1.1 All horizontal cables shall be labeled with self-laminating marking tape, Panduit LS8 labeler, or Owner approved equal. Identification shall be as follows:

3.2.1.1.1 At the BDF or IDF end, the data horizontal cables shall be labeled with the information indicating termination of the opposite end of the cables. This shall include room/hallway location and jack designation. Data jacks specifically used for WAPs shall include an “AP” acronym directly behind the room number. Place label on a visible part of cable within 12” of termination point for ease of identification after termination.

  e.g. At the BDF or IDF end the 4-pair data cable for the 1st location in room 1137 would be labeled: 1137AP-A and 1137AP-B

  e.g. At the BDF or IDF end the 4-pair data cable for the 1st location in hallway 1H01 would be labeled: 1H01AP-A and 1H01AP-B

  Size of letters and numbers shall be no less than 5/16” high by 1/8” wide.

3.2.1.2 Horizontal Patch Panel Labeling (Data):

3.2.1.2.1 At the BDF or IDF, data horizontal cables are terminated on their respective patch panels, with ports on the panels labeled in ascending room number order. All horizontal cables from same room should be terminated in sequential order at the patch panels.

  e.g. Single 4-pair cables will be labeled with a room location and a jack designation.

  e.g. 1137AP-A = the first data jack for a WAP in Room 1137, 1137AP-B = the second data jack for a WAP in Room 1137.

3.2.1.2.2 Size of letters and numbers on labels for patch panels shall be no less than 3/32” high by 1/16” wide.

3.2.1.3 Faceplate Labeling:

3.2.1.3.1 At the rooms, the jacks will be labeled on the faceplates using the plastic insert to cover a printed identification tag with room number and proper jack designation as follows:

  3.2.1.3.1.1 Jack designation: Data = A through Z.

  e.g. 1195AP-A = 1st data jack for WAP in Room 1195, 1195AP-B = 2nd data jack for WAP in Room 1195.

3.2.1.3.2 Size of letters and numbers on labels for faceplates shall be no less than 3/8” high.

3.2.1.4 Note: The WAP PICs shall be labeled in each room starting from A/B. These PICs do not fall within the alphanumeric order of the normal PICs within the same room.
3.3 Activating New APs

3.3.1 Warning: In order to comply with FCC radio frequency (RF) exposure limits, indoor antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons, unless otherwise directed by manufacturer's recommendation.

3.3.2 AP activation will only occur within 5 business days after ITIS has received and approved test results and the APs have been hung correctly.