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| Version | Date | Description of Revisions |
| 1 | November 1, 2011 | Standard Specification Release |
| 2 | April 20, 2015 | General formatting |
| 3 | August 8, 2017 | Updated form references to 1810 |
| 4 | January 20, 2020 | Replaced Record Drawings with As-Built Drawings (BM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**For each project the Consultant is responsible for the correct application of the specifications and for updating and modifying all highlighted items, as well as updating and modifying those sections that are directly applicable to the project. All updates and modifications to this standard document are to be highlighted to the Region for review and acceptance on each project.**

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GEneral

## General

### All conditions of the contract apply to the work of this section.

### Section 13520 is a functional specification. The Contractor is to provide all the devices necessary to meet the intent of this specification and to ensure a fully functional wide area network that meets the performance requirements specified herein.

### The radio system installer shall be named in the Form of Tender.

### Note that Telecommunications Companies may have wireless equipment installed and functioning at Region facilities. The Contractor is to ensure that they remain functioning at all times. Any damage or failures will be rectified at no cost to the Region.

## Technical Definitions

### Core Sites: The Core Sites are Newmarket Administration Centre and Bayview Operations Centre and are linked with a high bandwidth landline.

### Hub Site: Are the geographical operations hubs and PCS network centre’s in the Region and is linked to the Core Sites via redundant backhaul communications links. There are seven (7) Hub Sites in York Region:

#### Hub 1 - Georgina: Georgina WTP

#### Hub 2 – Stouffville-Whitchurch: Mt. Albert WWTP

#### Hub 3 - Newmarket: Bayview Operations Centre

#### Hub 4 - Aurora: Aurora Sewage Pump Station

#### Hub 5 – Hwy. 27: Nobleton WWTP

#### Hub 6 – Leslie East: Leslie Pumping Station

#### Hub 7 – Leslie West: Leslie Pumping Station

### Radio Hub Site: A Radio Hub is the extension point of the Hub PCS network to a Remote Facility and is linked to the Hub Sites or Core Sites via redundant backhaul communications links.

### Remote Facility: A Remote Facility can communicate with another Remote Facility, and a Hub or Radio Hub site.

## Scope of Work Definitions

### The following terms are used in this specification to describe the scope of work associated with various devices. The terms shall have the following definitions in this context:

#### Abandon: Abandon and make safe all process and electrical connections, make pertaining process and electrical systems work safely after disconnection of abandoned item(s).

#### Free-issue: Equipment or services supplied by the Region for incorporation into the Contract by the Contractor.

#### Reasonably to Scale (RTS): Dimensions shown are approximate only. Contractor to field verify the dimensions prior to starting work.

#### Provide: Supply the named device or equipment and all necessary appurtenances, install, test and commission. Unless otherwise noted, the device or equipment supplied and all appurtenances shall be new.

#### Remove: Abandon and make safe all process and electrical connections, remove the item and mend the void space/process to its intended function.

#### Replace: Verify that replacement material fits the replaced item and provide adapters as required, abandon and make safe all process and electrical connections, remove the item, supply and install new item with required adapters, make pertaining process and electrical systems work safely after replacing item(s).

#### Re-wire: Abandon electrical connections to existing and install new wiring and conduit to new destination, as indicated.

#### Region: Refers to the designated Region Staff or Region Representative.

#### Consultant: The term Consultant is used interchangeably with the term Contract Administrator and has the same meaning.

## References

### Comply with the latest edition of the following statutes codes and standards and all amendments thereto.

#### Institute of Electrical and Electronics Engineers, Inc. (IEEE):

#### CSA S37-01 Antennas, Towers and Antenna-Supporting Structures for Tower Manufacture and Installation

#### TIA/EIA-195C, Electrical and Mechanical Characteristics for Terrestrial Microwave Relay System Antennas and Passive Reflectors

#### Ontario Provincial Standard Specification, Construction Specification for Pole Erection (OPSS 615)

#### Ontario Electrical Safety Authority, Section 75-242 “Setting of Poles” and Specifications 6, 7, and 8

#### Industry Canada regulation RSS-210 “Low Power License-Exempt Radio communication Devices” that pertain to the outdoor application of the following unlicensed frequency ranges: 5725 to 5875 MHz

#### Conform to the IEEE 803 standard for all 5.8 GHz intra-radio links

#### Conform to Health Canada’s Radiofrequency Exposure Guideline - Safety Code 6.

#### Where copper or fibre optic Ethernet cabling is installed:

##### TIA/EIA-568-B, Telecommunications Cabling Standard. All standards referenced within the TIA/EIA-568-B standard, where applicable, constitute standard provisions of this specification

##### Ontario Electrical Safety Code, Section 56 – Optical Fibre Cables

##### Ontario Electrical Safety Code, Section 60 – Communication

##### TIA/EIA-606: Administrative Standard for Telecommunications

#### Ontario Electrical Safety Code.

## Sites

### The following 5.8 GHz Sites are included in the scope of work:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Site | Address | New/ExistingFacility | Antenna TypeOmni/Directional | Coaxial1/2” or 7/8” | Antenna Elevation (m) | GPS Coordinates |
| Add sites as needed |  |  |  |  | See path profiles |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

### The Consultant is to perform a desktop radio path study to determine the antenna elevations. The Consultant is to submit radio link calculations and path profiles using components approved by the Region.

### The Contractor is to perform link verification and complete the link test reports during construction.

## Scope of Work

### The work to be done under this Contract includes, but is not limited to, the supply of materials, labour, equipment, permits, etc. necessary for the complete construction of the works shown on the Tender drawings and as specified herein. The following is a general, but not necessarily complete, description of the work to be done:

#### Provide and install a 5.8 GHz wireless Ethernet Bridge, with integrated antenna, lightning protection, cabling, pole, mast, managed network switch, and appurtenances at all Remote Facilities, Hubs, and Radio Hubs included in this contract.

## Radio Link Performance Requirements

### The radio links provided by the Contractor will meet the following minimum radio link performance requirements:

#### Provide a signal fade margin for each radio link that ensures one way annual availability of 99.995 percent or greater. At the Region’s discretion, lower link availability may be accepted. Under no circumstances will a one way annual availability or worst month availability be accepted that is less than 99.95 percent.

#### The Effective Isotropic Radiated Power (EIRP) of all links will comply with Industry Canada, Radio Standard Specification RSS-210, for *Low Power License Exempt Radio Communication Devices* and all amendments*.*

#### The minimum data rate for 5.8 GHz point-to-point links will be 50 Mbps at a Bit Error Rate (BER) of 10-6.

#### For some radio links it may not be feasible to meet the performance requirements specified due to environmental constraints. The Region places a higher priority on the reliability of the link than the data rate. Compliance with Industry Canada regulations is mandatory. The determination of feasibility with respect to meeting the performance requirements will be at the sole discretion of the Region.

#### The 5.8 GHz wireless network will comply with the IEEE 802.3 standard, unless otherwise noted or agreed.

#### These standards utilize frequency bands that are regulated but not licensed by Industry Canada. It is understood by the Region that at anytime during construction or after contract completion that interference from another radiation source, operating in the same frequencies, may affect the operation or performance of any wireless link in the network. If it was reasonable for the Contractor to have identified the interfering source during the pre-construction or construction phase of the contract, the Contractor will be required to take the necessary steps to eliminate or mitigate the interference.

## Submittals

### Comply with the requirements of Section 01340 – Shop Drawings, Product Data, and Samples. Section 13520 shall take precedence where there is a contradiction with Section 01340.

### All Shop and As-Built drawings submitted by the Contractor will comply with the Region’s CAD standards and shall be generated with the latest version of AutoCAD. All drawings will be formatted for and submitted on 594 mm x 841 mm ISO A1 paper.

### Prior to starting construction submit radio link calculations and path profiles (Pre-Construction Link Verification) using components approved by the Region and dimensions determined by the Contractor. The radio link calculations are in addition to the requirements of Section 01340. Radio link calculations will be performed utilizing the *Telecommunication Union, ITU Radiocommunication Assembly, Rec. ITU-R P.530* model.

### Prior to starting construction at any site submit the Site Antenna Installation drawing.

### Submit proposed tag labels for cable, equipment and enclosures to the Region for approval before proceeding with this work.

### Submit the following documentation four (4) weeks prior Site Acceptance Testing: test plan, test sheets, working drawings, As-Built drawings.

### Submit the Network Operations and Maintenance Manual, in compliance with Section 01730, within two (2) weeks following the completed Site Acceptance Test.

### Submit a description of any proposed network testing tools (software or hardware) required to meet the intent of the Link Acceptance Test (LAT), Network Acceptance Testing (NAT), four (4) weeks prior to LAT. Following LAT, submit original signed copy of Region LAT test sheet.

### Submit a description of any proposed network testing tools (software or hardware) required to meet the intent of the Network Acceptance Test (NAT), four (4) weeks prior to Network Acceptance Testing. Following NAT, submit original signed copy of Region NAT test sheet.

### Submit a description of any proposed network testing tools (software or hardware) required to meet the intent of the Transmission Cable Test (TCT), four (4) weeks prior to Transmission Cable Testing and Link Acceptance Testing. Following TCT, submit original signed copy of Region TCT test sheet.

### Submit configurations for all managed network equipment installed and configured by the Contractor for review and acceptance by the Region two (2) weeks in advance of the Network Acceptance Test. Final configurations shall be included in the Operations and Maintenance Manual.

### Submit photographs of the work performed as sites are completed. Photographs will include as a minimum the site, the control panel, the underground conduit, the top of the pole (taken from eye level), grounding rod installations/configuration. All obstructions, if any, must be photographed and identified.

#### For radio hub sites, submit photographs taken from the top of each antenna for the entire beamwidth of the antenna. If identifiable, take photographs of the receiving radio hub site(s).

### Submit WAN construction schedule within seven (7) calendar days following the contract kick-off meeting.

### Supply the Region with six (6) hardcopies and electronic versions on CD of each submittal. CAD files will be in the latest version of AutoCAD format and configuration files will be in plain text. All other electronic versions will be in PDF format.

# PRODUCTS

## Antenna Masts

### Elevated Tank Mast:

#### The mast height will be dependent on the number of antennas on top of the elevated tank. Co-locating with the existing antennas on top of the tower must be considered. As a minimum, a 2 metre vertical and horizontal separation distance should be used. Mast and antenna connections shall be in compliance with the 13520B SCADA 5800MHz Wireless Details drawing.

#### The mast shall be minimum 3” diameter schedule 40 aluminum pipe with top cut at 45 degree angle, with the appropriate mounting hardware to securely fasten to railing on top of elevated tank.

#### LPU to be grounded to elevated tank ground located on top of tower.

## Antenna Mast Clamps

### Pipe to Pipe Mount:

#### Antenna Mast Clamps shall be by Andrew Corporation, AB-S50-SSH.

#### Provide all u-bolts, screws, bolts, nuts, washers and necessary appurtenances to mount the antenna mast as functionally detailed in the tender drawings and according to manufacturer installation recommendations.

## Surge Protectors

### 5.8 GHz Lightning Surge Protector:

#### The lighting surge protector shall be PTP-LPU by Motorola, part number WB2978AA. A quantity of 2 lighting surge protectors required per link.

## Outdoor Ethernet Cable

### Outdoor Ethernet Cable:

#### Outdoor Ethernet cable shall be Superior Essex Inc. OSP Broadband Category 5e cable, part number 04-601-55.

### Outdoor Ethernet Cable Connectors:

#### RJ45 Shielded liner plug, Category 5e connector as per wireless bridge manufactures recommendations.

## Wireless Bridges

### 5.8 GHz Ethernet Wireless Bridge:

#### The 5.8 GHz Wireless Ethernet Bridge shall be Motorola PTP58500 radio with integrated antenna, part. MCP-WB2859AA.

#### PIDU Plus (Power Indoor Unit Plus) by Motorola to be supplied with radio installation.

# EXECUTION

## General

### The Regional Municipality of York, Water and Wastewater Facilities, SCADA Wide Area Network (WAN) is a mission-critical network requiring a high-degree of reliability and robustness. The Contractor is responsible for constructing a wireless network that meets the performance criteria specified within this specification.

### This specification is a functional specification. Therefore, it is the responsibility of the Contractor to bring to the attention of the Region any design, equipment or installations issues, which the Contractor believes may prevent the network from meeting any of the minimum performance requirements or comply with this specification. The Contractor will recommend solution/s, in writing to the Region, including impact to scope, time and cost. The Region will, in its sole discretion, make a determination if the identified issue/s will or will not negatively impact network performance.

### Complete all network enclosure installations as per Division 13.

## Sequence of Construction

### Complete all work associated with Hubs, and Radio Hubs. The sequence of work is as follows:

#### Consultant to provide.

### Complete all work associated with Remote Facilities. The sequence of work is as follows:

#### Consultant to provide.

### Prior to performing site acceptance test of WAN components and complete Site Acceptance Testing of Remote Facilities, Hubs, and Radio Hubs.

## Mandatory WAN Meetings

### The Contractor’s WAN representative (the person responsible for the construction of the WAN) and the Contractor’s Project Manager shall attend these mandatory meetings. These meetings are in addition to routine construction meetings.

### A WAN kick-off meeting will be held at the pre construction meeting to review this specification and Wide Area Network (WAN) Tender drawings in detail. Major WAN milestones will be identified with the Contractor to incorporate into their overall project schedule.

### Two (2) additional meetings will be called at the discretion of the Consultant to review issues relating to construction of the WAN. The Contractor will be provided two (2) weeks notice of a meeting.

## Pre-Construction Link Verification

### The Contractor’s WAN representative (the person responsible for the construction of the WAN) and the Contractor’s Project Manager shall attend these mandatory meetings. These meetings are in addition to routine construction meetings. The Contractor’s WAN representative is to be named in the Form of Tender and will not be the Contractor’s project manager.

### Measure and record the site coordinates (latitude and longitude) utilizing a GPS. Compare to Region supplied coordinates and report any discrepancies, otherwise use Region values.

### Determine the azimuth and inclination for the line-of-site path for the link.

### Measure or determine the site altitude above mean sea level to an accuracy of plus or minus three (3) metres. Indicate method of measurement.

### For all 5.8 GHz link calculations use a BER of 10-6.

### Generate Radio Link Report using LINKPlanner tool by Motorola and submit to the Region for review.

### Accepted Radio Link Calculations will form the performance criteria for the Link Acceptance Test (LAT).

## Cable Acceptance Testing - General

### This section specifies the inspection, test, and acceptance requirements for the transmission cabling of the Wide Area network.

### Provide all of the test equipment required to conduct acceptance tests.

### All of the installed cabling must be tested and successfully pass all test criteria.

### Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Region.

### The Region reserves the right to conduct, using Contractor equipment and labour, a random re-test of up to twenty (20) percent of the outdoor Ethernet cables to confirm documented results. Any failed cabling shall be re-tested and restored to a passing condition. In the event more than five (5) percent of the cable fails during re-test, the entire cabling shall be re-tested and restored to a passing condition at no additional cost to the Region.

### Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation as specified.

### The maximum allowable distance for Ethernet copper cable runs is 90m including all patch cables. The Region may agree to allow certain cable runs to exceed acceptable standardized performance criteria. If required these cable runs will be exempt from meeting the specified standards. However, the Contractor will still be required to test these cable runs to validate component and installation performance.

### Outdoor Ethernet Cable Test Equipment. Test equipment shall meet the following minimum criteria:

#### All test equipment of a given type shall be from the same manufacturer, and have compatible electronic results output. Acceptable test equipment manufacturers are Fluke, HP, or MicroTest.

#### Test adapters must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.

#### Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing.

#### Test equipment must be capable of certifying Category 6 UTP to TIA/EIA-568-B.2 standards.

#### Test equipment must have a dynamic range of at least 200 dB to minimize measurement uncertainty.

#### Test equipment must be capable of storing full frequency sweep data for all tests.

#### Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.

#### Test equipment must be capable of running individual NEXT, return loss, etc., measurements in addition to autotests. Individual tests increase productivity when diagnosing faults.

#### Test equipment must make swept frequency measurements in compliance with TIA/EIA-568-B standards.

#### The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

### Cable Test Results Manual:

#### Submit test reports in both a hardcopy and electronic format. Hand-written test reports are not acceptable. Submit electronic files on a CD format disk in a PDF format. If test results cannot be converted to a PDF format then provide any necessary proprietary software to view the results at no cost to the Region.

#### Submit five (5) copies of the Cable Test Results manual. The manual consists of hardcopy test result reports placed into lockable ‘D’ ring binders with a cover and spine that clearly indicates the title of the manual. Put a CD with the electronic copies of test reports in a pocket in the Cable Test Results manual.

#### Both the Contractor and Contract Administrator must sign hardcopy reports.

#### design, material changes**,** final elevations and azimuths**.**

## 5.8 GHz Remote Facilities, Hubs, and Radio Hubs

### This section applies to all 5.8 GHz Remote Facilities, Hubs, and Radio Hubs listed in Section 1.5, Sites of this specification.

### Mounting Pipe

#### Provide a 76 mm (3”) stainless steal or hot dipped glvinized mounting pipe for the mounting of the Remote Facility, core site, or Radio Hubs.

#### The mounting pipe is to be straight and true.

#### The mounting pipe will function as a lightning rod and therefore shall extend a minimum of 914 mm (36”) above the antenna mounting clamp. The top of the mounting pipe is to be cut at a 45 degree angle.

#### All fixed mounting hardware (except the pipe) is to be manufactured from hot-dipped galvanized or stainless steel.

#### All moveable hardware (washers, nuts, bolts) is to be manufactured from stainless steel.

#### Wireless Ethernet Bridge to be mounted and secure to mounting pipe via pre-fitted mounting bracket.

### Outdoor Ethernet Network Cable

#### Provide outdoor Ethernet network cable and all appurtenances to link the wireless Ethernet bridge with the SCADA network in compliance with this specification. The average outdoor network cable length is sixty (60) metres. Contractor is to verify length of run after location of antenna is approved. Maximum permissible length is 90 metres.

#### Install the outdoor Ethernet network cable to comply with manufacturer’s recommended installation practice.

#### Any outdoor Ethernet network cable bend radius shall be greater than the minimum bend radius specified by the manufacturer.

#### Outdoor Ethernet network cable is to be a continuous run, without splices or connections, from the top wiring-aperture to the lightning surge protector mounted at the base of the tower or wall at the cable entrance point leading of the network.

#### Provide cable support, as necessary, to meet manufacturer’s recommended installation practice. As a minimum, anchor the outdoor Ethernet network cable at the top of mast using either, a compression fit, cushioned clamp or hoisting grip fixed securely to the mast. Tie wraps are not permitted.

#### All installed outdoor Ethernet network cable connectors, glands and lighting protection units are to be watertight. Weatherproofing kit to be Scotch Wireless Weatherproofing Kit WK-101 by 3M. Weatherproofing to be completed as per manufacturers recommendations This weatherproofing will be in addition to any weatherproofing supplied by the manufacturer as part of the cable assembly or the connector.

#### The outdoor Ethernet network cable is to enter the radio hub closet (if applicable) or control panel near the bottom-side of the panel.

### Grounding System

#### Provide an outdoor Ethernet network and wireless Ethernet bridge grounding system in compliance with the 13520B SCADA 5800MHz Wireless Details drawing.

#### Lightning protection to be provided for network cabling located within 2 meters of wireless bridge.

#### External lightning protection to be provided for network cabling at point of entry into facility leading to the network.

#### Comply with Sections 10 and 54 of Ontario Electrical Safety Code.

#### Bond network cabling system ground to existing building ground as close as possible to the building point of entry. As a minimum, bond network cabling system ground to existing grounds with a No. 6 AWG copper wire that is as straight and short as possible.

#### Bond network cable system ground to a solid copper ground bar within the PAC panel.

#### Bond the wireless Ethernet radio at the pole top. The ampacity of the ground conductor shall be equal to or greater than the ampacity of the lightning protection unit. Installed grounding kits are to be watertight.

#### Bond wireless Ethernet radio mounting pipe and lightning protection units to antenna tower grounding rod utilizing a No. 6 AWG ground conductor. Ground wire is to be clamped to the mounting pipe securely with a minimum of two (2) pipe clamps.

#### At the time of installation, the site resistance relative to ground must be less than or equal to 5 ohms as per IEC61024.

#### Grounding kit by Andrew, A CommScope Company to be installed on all copper Ethernet cabling where it enters into a valve chamber and/or the room hosing the PAC panel and network panel.

### 5.8 GHz Wireless Ethernet Bridge

#### Provide a 5.8 GHz Wireless Ethernet bridge as specified.

#### The mounting plate and mast shall be installed on the top of the facility, tower or on the elevated tank on the existing hand rails. The mounting plate shall be manufactured from aluminum with the following minimum dimensions: 370 mm (14.5”) L x 370 mm (14.5”) W x 6.35 mm (0.25”) D.

#### Test and commission the Wireless Ethernet bridge with Region staff to ensure a consistent wireless link.

#### All wiring is to be neatly dressed and run within cable managers.

#### Fit a drip loop on the PIDU Plus to Wireless Ethernet Bridge cable to ensure that moisture does not run in to the PIDU Plus.

### Antenna Alignment

#### Each Remote Facility antenna is to be aligned with a Hub, Radio Hub, or another Remote Facility antenna. The Contractor is to record signal strength and quality at both sites for submission to the Consultant.

#### Digital Voltmeter (DVM) to be used to verify antenna alignment proportional to receive Signal Strength for coarse adjustment of antenna position.

#### For fine adjustment, align the antenna with measured azimuth, elevations and a GPS coordinates utilizing the Wireless Ethernet Bridge audible tones until highest pitch tone is received. Adjust by making small incremental movements in angular alignment. Adjust for each of the states as defined in the manufacturers installation and commissioning literature.

#### Copies of wireless link graphical views from Manufacturer Web Interface Tool are to be provided from installation showing alignment process and final alignment.

### Patch Cords

#### Provide three (3) CAT6 patch cords as a minimum, or as required certified by the manufacturer.

#### Patch cords will be sized to suit + 30 cm (maximum) in length.

### As-Built Drawings

#### Utilising copies of the “Typical” drawings submitted with the tender, the Contractor will create and submit red-lined As-Built drawings for each radio hub site. As a minimum, the Contractor shall annotate the drawings with the following details: all final dimensions, equipment location, approved design, material changes, final elevations and azimuths.

#### Provide completed Resistance Values Table and Link Identification Table from Manufacturer Deployment Guide.

## Testing

### Failed test results to be submitted to Region with suggested corrective action. After corrective action is implemented, test is to be repeated. In all tests, a 100% successful pass rating is required for acceptance of completion.

### The Contractor is required to provide all testing equipment including laptops and manufacturer testing software and LINKPlanner Radio report.

### Site Acceptance Test (SAT) – All Radio Hub Sites

#### All Radio Hub sites will undergo a witnessed Site Acceptance Test (SAT).

#### Site Acceptance Tests will evaluate the workmanship and verify installation against this specification, As-Built and Shop drawings.

#### Prepare a checklist or test sheet using Microsoft Excel.

#### The Contractor shall conduct the test when directed by the Region.

#### The SAT will be completed when all items in the checklist have been witnessed and initialed by the Region as being in conformance with the design as specified.

### Link Acceptance Test (LAT)

#### All sites will undergo a witnessed Link Acceptance Test (LAT). Perform all link acceptance tests where supported by the manufacturer’s radio and/or manufacturer supplied diagnostic tools to confirm link status. Complete LAT test sheet provided by Region and submit original signed copy.

#### Perform all radio link tests at both ends of the radio link.

#### Copies of wireless link graphical views and System Statistics from Manufacturer Web Interface Tool are to be provided for the final installation.

#### Measure and record Histogram Data using Manufacturer Web Interface Tool for four (4), one (1) hour intervals. Exported csv Histogram Data files for all diagnostics are to be provided to the Consultant and Region for acceptance of LAT.

#### Measure and record Histogram Data using Manufacturer Web Interface Tool for first 24 hr period. Exported csv Histogram Data files for all diagnostics are to be provided to the Consultant and Region for acceptance of LAT.

### Network Acceptance Test (NAT)

#### The witnessed Network Acceptance Test (NAT) will test Ethernet performance of overall network including the Wireless and their connections to the core and Radio Hub local area networks. Complete NAT test sheet provided by Region and submit original signed copy.

#### Using laptops connected to the network at both ends of the link and suitable TCP/IP test software perform a “Ping” test. The latency of the ping test shall be less than 2 msec. Packet losses shall not exceed 0.001%. Repeat the test ten (10) times and record the minimum, maximum and average latency.

### Outdoor Ethernet Cable test

#### Measure and record actual length and maximum allowable length. Any individual test that fails the link length criteria shall be marked as FAIL.

#### Record tester manufacturer, model, serial number, software version, last calibration date, lab details, link criteria, pass/fail indication, and date/time of test.

**END OF SECTION**