METROLINX

GO Site Radio Devices Installation Standard

MX-STC-STD-004

Revision 00
Date: May 2023

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Publication Date: May 2023

Metrolinx,

an Agency of the Government of Ontario

Preface

This is the first edition of the GO Site Radio Devices Installation Standard (MX-STC-STD-004). Metrolinx has been rapidly expanding, and therefore, the demand for reliable radio coverage has been expanding as well. The purpose of this standard is to establish an installation standard that must be followed by all sub-contractors, technicians, specialists, and all others involved in the installation of radio sites.

The technical content within the GO Site Radio Devices Installation Standard (MX-STC-STD-004) was developed by the Metrolinx radio systems office within Engineering and Asset Management Division, which includes specialized subject matter experts. This Standard is available for external users to download via the Metrolinx public download site at http://www.gosite.ca/engineering_public/

Suggestions for revision or improvements can be sent to Metrolinx Radio Systems, Attention: Senior Manager, Radio Systems, who will introduce the proposed changes to Metrolinx Radio Systems. The Senior Manager, Radio Systems, ultimately authorizes the changes. A description of the proposed change shall be included along with information on the background on the background of the application and any other useful rationale or justification. Proposals for revisions or improvements shall include your name, company affiliation (if applicable), e-mail address, and phone number.

May 2023

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1. Introduction

1.1 General

1.1.1 In planning, installing, or modifying any antenna tower or other antenna site, the need to comply with regulations and standards concerning human exposure to RF energy must be considered. Factors to be considered include

a) The location, direction, transmission power, frequency, physical characteristics, and design of all antennas and other equipment at the site, considering the existing or possible human occupation or usage of the adjacent areas

b) Any necessary and appropriate steps to limit or control human access to adjacent areas, including limited-access doors, fencing, signs, and training

c) Appropriate operational procedures to ensure ongoing compliance with radio frequency (RF) energy exposure regulations and standards when the antenna site is operational.

1.1.2 Metrolinx, as a provincial Crown Agency, is requiring that all contractors and employees follow all federal regulations or acts, including the Radiocommunication Act and operate only Commercial/Professional Radios with licensed channels for any radio site installation.

1.1.3 This standard is of mandatory adoption to ensure that all UHF radio site installations follow approved Metrolinx Radio Systems Communication practices and standards. Furthermore, the standardization of radio site installations ensures that all radio sites are installed in compliance with RF energy exposure standards as outlined in RF Safety Code 6.

2. Definitions, interpretation, codes, and standards

2.1 Definitions

2.1.1 Capitalized terms used in this standard shall have the meanings prescribed in Table 1.

Table 1: List of definitions

Term	Definition
"Amplifiers"	An electronic device that increases the power of an electrical signal. It is commonly used to increase the level of an audio signal or to amplify an electrical signal in scientific instruments.
"Antenna"	A device that converts electrical signals into electromagnetic waves and vice versa. It is used to transmit and receive radio frequency signals, such as those used for radio and television broadcasting, wireless communication, and satellite communication.
"Battery Bank"	A collection of two or more batteries wired together to provide a larger overall capacity of electrical energy storage. It is commonly used in off-grid or backup power systems to store energy from solar panels, wind turbines, or other sources for use when the primary power source is not available.
"BNC Connector"	A type of coaxial connector commonly used in video and radio frequency (RF) applications. It features a bayonet-style locking mechanism for secure and quick connections and is used in applications such as CCTV cameras, oscilloscopes, and computer networking.
"Bonding bar"	A metal bar used to connect two or more metallic objects together to create a common ground. It is commonly used in electrical systems to ensure that all metallic components are at the same electrical potential, thereby reducing the risk of electrical shock or damage to equipment.
"Channel"	A communication path through which information can be transmitted, such as a frequency band used for radio or television broadcasts, or a digital pathway used for data transmission over the internet.

Term	Definition
"Coaxial Cable"	A type of electrical cable consisting of a central conductor surrounded by a concentric layer of insulation and a grounded shield. It is commonly used to transmit high-frequency signals with low loss, such as for cable television, internet connectivity, and radio communication.
"Combiner"	An electronic device used to combine two or more input signals into a single output signal. It is commonly used in radio frequency (RF) applications, such as in antenna systems or in signal amplification, to combine multiple signals with minimal insertion loss and without interference.
"Comparator"	An electronic device that compares incoming voice signals from multiple receivers and votes or selects the best signal for retransmission.
"Control Channel"	A communication channel used in telecommunications systems to transmit control information between devices. It is typically used to establish and maintain communication links, manage call routing, and allocate network resources.
"Grounding"	Known as earthing, is the process of connecting electrical equipment or structures to the earth or a ground plane. It prevents electric shock, protects equipment from damage due to static electricity or lightning strikes, and improves signal quality in electronic systems.
"Metrolinx"	Means Metrolinx, a non-share capital corporation continued under the Metrolinx Act, S.O. 2006, c.16 and a Crown Agency in accordance with the Crown Agency Act, R.S.O. 1990, c.48 and includes all operating divisions.
"N-Type Connector"	A type of coaxial connector used for high-frequency applications. It features a threaded coupling mechanism and is designed to offer low loss and high-power handling capabilities. N-connectors are commonly used in RF and microwave communication systems, such as in antennas, amplifiers, and transceivers.
"Power Supply"	An electronic device that converts AC or DC electrical power from a source to the correct voltage, current, and frequency needed to power other electronic devices or systems.

Term	Definition
"P25"	Project 25 is a suite of digital radio communication standards used in public safety and emergency response applications. It is designed to ensure interoperability and compatibility between different radio systems used by various agencies and jurisdictions, allowing first responders to communicate effectively during emergency situations.
"Radio Frequency"	It is the number of radio waves per second.
"Receiver"	An electronic device that receives and decodes signals transmitted over radio waves, including audio, video, and data signals.
"Redundancy"	Refers to having multiple back-up communication modalities and is imperative in emergency preparedness planning.
"Repeater"	An electronic device that receives and amplifies a signal before transmitting it at a higher power to extend its range. It is commonly used in radio communication systems to overcome distance limitations or obstacles that obstruct the signal.
"RJ45"	A type of modular connector commonly used for Ethernet networking. It features eight pins arranged in a specific configuration to provide a reliable and standardized connection between networking devices.
"R56"	Standards and guidelines for communication sites
"RF Safety Code 6"	A Canadian standard that sets limits on human exposure to radiofrequency (RF) electromagnetic energy in the frequency range of 3 kHz to 300 GHz, providing guidelines for the safe use of RF emitting devices and equipment. It includes regulations for the measurement and assessment of RF exposure, as well as mitigation strategies to minimize potential health risks.
"Site Controller"	A network device that manages and controls multiple access points and other wireless devices within a specific geographical location. It enables centralized management of wireless networks, allowing administrators to monitor and configure wireless devices, as well as enforce security policies and apply firmware updates from a single interface.

Term	Definition
"Transmitter"	An electronic device that converts an electrical signal into a radio frequency (RF) signal and sends it through an antenna to a receiver.
"Wavelength"	A physical characteristic of a wave that represents the distance between two adjacent peaks or troughs of the wave. It is typically measured in meters and is used to describe various types of waves, including electromagnetic waves such as light, radio waves, and X-rays, as well as sound waves. Represents the oscillation rate of electromagnetic waves measured in Hertz (Hz).

2.2 Abbreviations

2.2.1 The abbreviations used in this standard shall have the meaning prescribed in Table 2.

Table 2: List of abbreviations

Abbreviation	Definition
ATS	Automatic Transfer Switch, an electrical switch that automatically switches a power source from a primary to a backup power source in the event of a power outage.
CEN	Customer Enterprise Network is an enterprise network is the backbone for facilitating Metrolinx Radio Systems analytic tools and connecting radio devices throughout the radio network. (CEN)
DSR	Dynamic System Resilience provides information to understand, operate, maintain, and troubleshoot the Dynamic System Resilience (DSR) feature which is implemented on Metrolinx ASTRO 25 system. DSR adds a geographically separate backup zone core to an existing zone core to protect against catastrophic zone core failures.
DTF	Distance to Fault measurement is a method used in the field of telecommunications to locate faults in a transmission line by measuring the distance from the point of measurement to the fault.
ESD	Electrostatic discharge is a sudden and momentary flow of electric current between two electrically charged objects caused by contact, an electrical short or dielectric breakdown.
GPS	Global Positioning System. It is a satellite-based navigation system that allows users to determine their precise location and track movements in real-time.
IDU	Refers to the Indoor Unit component of a wireless networking solution provided by Cambium Networks.
IEC	International Electrotechnical Commission. It creates Standards for electrical and electronic technologies
ISED	Innovation, Science and Economic Development Canada, (formerly IC – Industry Canada). It is the government agency that among other things is in charge of licensing the radio spectrum and resolve interference disputes of licensed frequencies.

Abbreviation	Definition
LMR	Land Mobile Radio, is a term used in the field of wireless communication to describe a two-way radio system used by organizations such as public safety agencies, transportation companies, and utilities.
MOSCAD	Provides information required to install, configure, manage, and use the MOSCAD Network Fault Management (NFM), an ASTRO 25 solution that provides tools to configure, monitor, and control auxiliary system devices (such as tower lights, power, and environmental equipment) in communication sites.
NFPA	National Fire Protection Association is a non-profit organization that develops and publishes codes and standards related to fire prevention, life safety, and electrical safety.
OSHA	Occupational Safety and Health Administration is a federal agency in the United States that is responsible for ensuring safe and healthy working conditions for workers.
PDU	Power Distribution Unit is a term used in the field of electrical engineering and data center management to describe a device that distributes power to multiple devices or servers.
PPE	Personal Protective Equipment refers to equipment and clothing designed to protect individuals from hazards that may cause injury or illness in the workplace or other settings.
SDM3000	A series of remote terminal units used in industrial control systems for monitoring and controlling various processes.
SM	Single-Mode fiber is a type of optical fiber designed to carry a single ray of light with very high bandwidth and long distances. It has a small core diameter of around 8-10 microns, which enables it to maintain the signal strength and quality over long distances without the need for amplification or regeneration.
UHF	UHF, which means Ultra High Frequency, is the designation for radio frequencies in the range between 300 megahertz (MHz) and 3000 megahertz (MHz).
UPS	Uninterruptible Power Supply is a device that provides backup power to electrical equipment in case of a power outage or other power disruptions

2.3 Codes, standards and reference documents

2.3.1 All systems, equipment and materials required for work relating to this standard, shall be provided by Metrolinx in accordance with the most current edition of applicable federal, provincial, Municipal, and industry codes, standards, and guidelines (collectively, "Standards and Guidelines") including the following:

a) R56 Guidelines

b) *Radiocommunication Regulations*

c) Canadian Centre for Occupational Health and Safety

d) Canadian Standards Association (CSA)

3. Site radio devices installation

3.1 Site radio preparation

3.1.1 All systems and equipment preparation into an existing radio shelter involves assessing the space available in the shelter, evaluating existing equipment for compatibility with new equipment, procuring and preparing the new equipment for installation, connecting all necessary cables and connectors, testing the equipment to ensure proper operation, and properly labelling and storing all documentation related to the installation.

3.1.1.1 Metrolinx Radio Systems shall identify all the components shown in the radio system diagram, such as antennas, cables, amplifiers, repeaters, radios, and other devices. Make sure you understand the purpose and function of each component to be installed. See figures 1, 2, 3 and 4.

Figure 1: DSR Zone Core

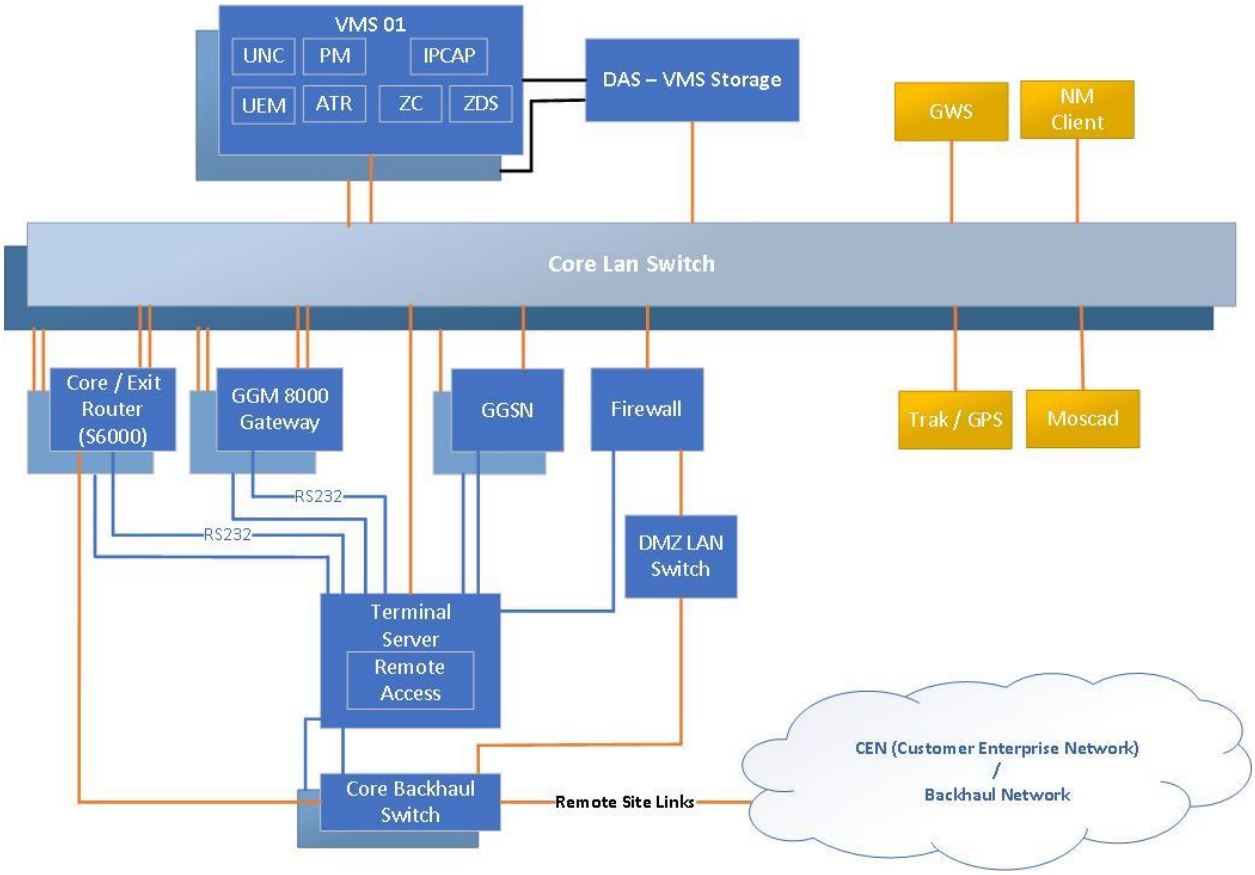


Figure 2: Primary and Geo Prime Site

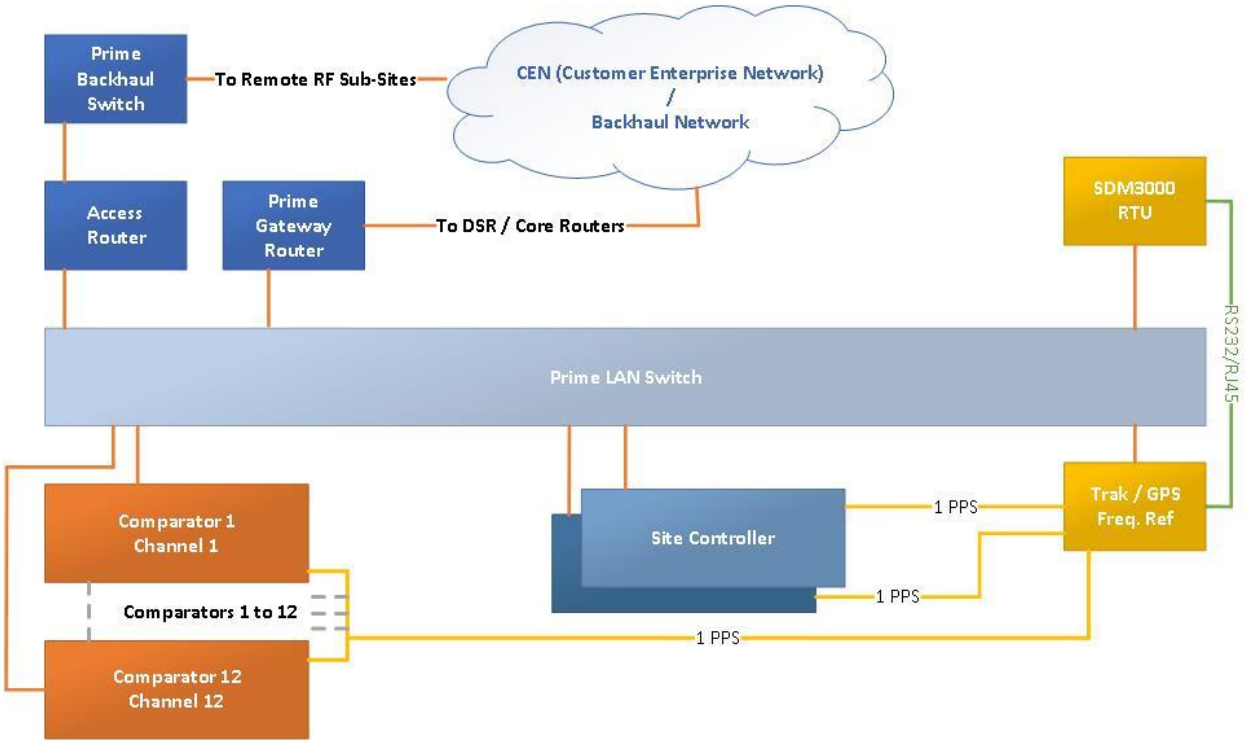


Figure 3: RF Sub-site

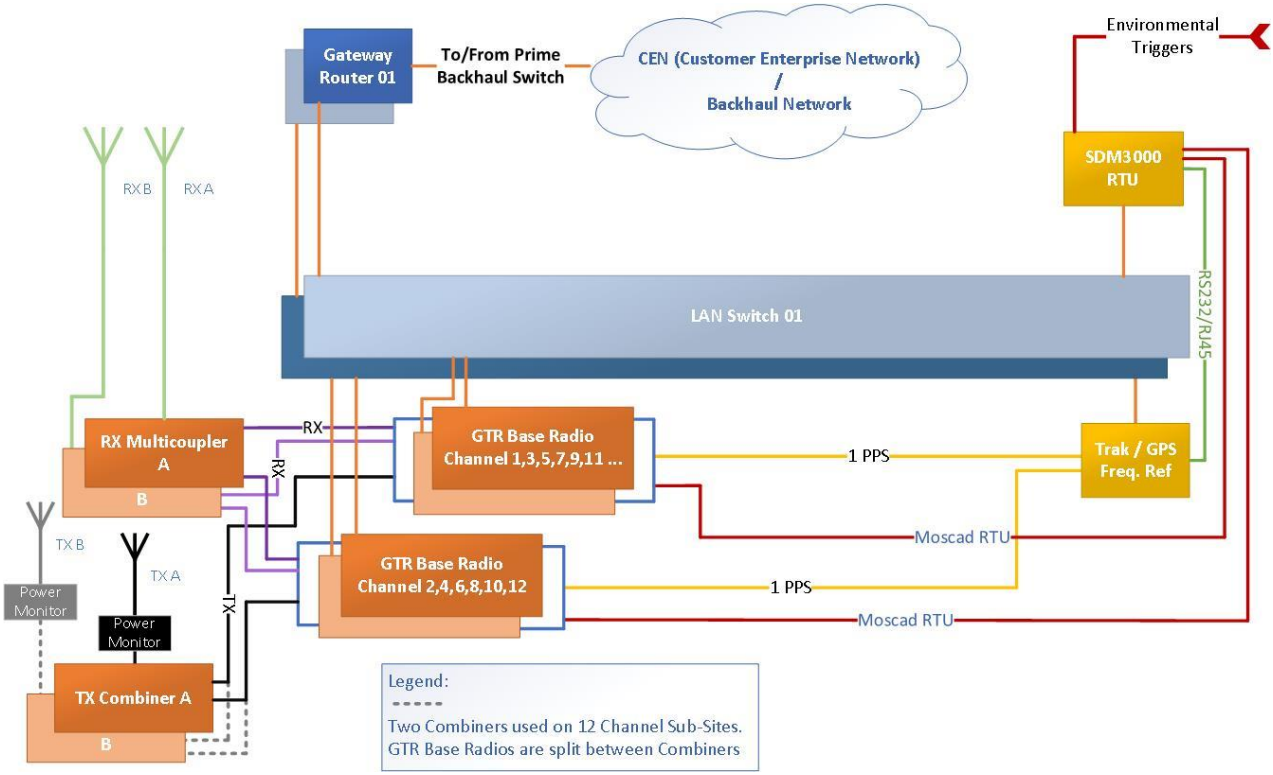
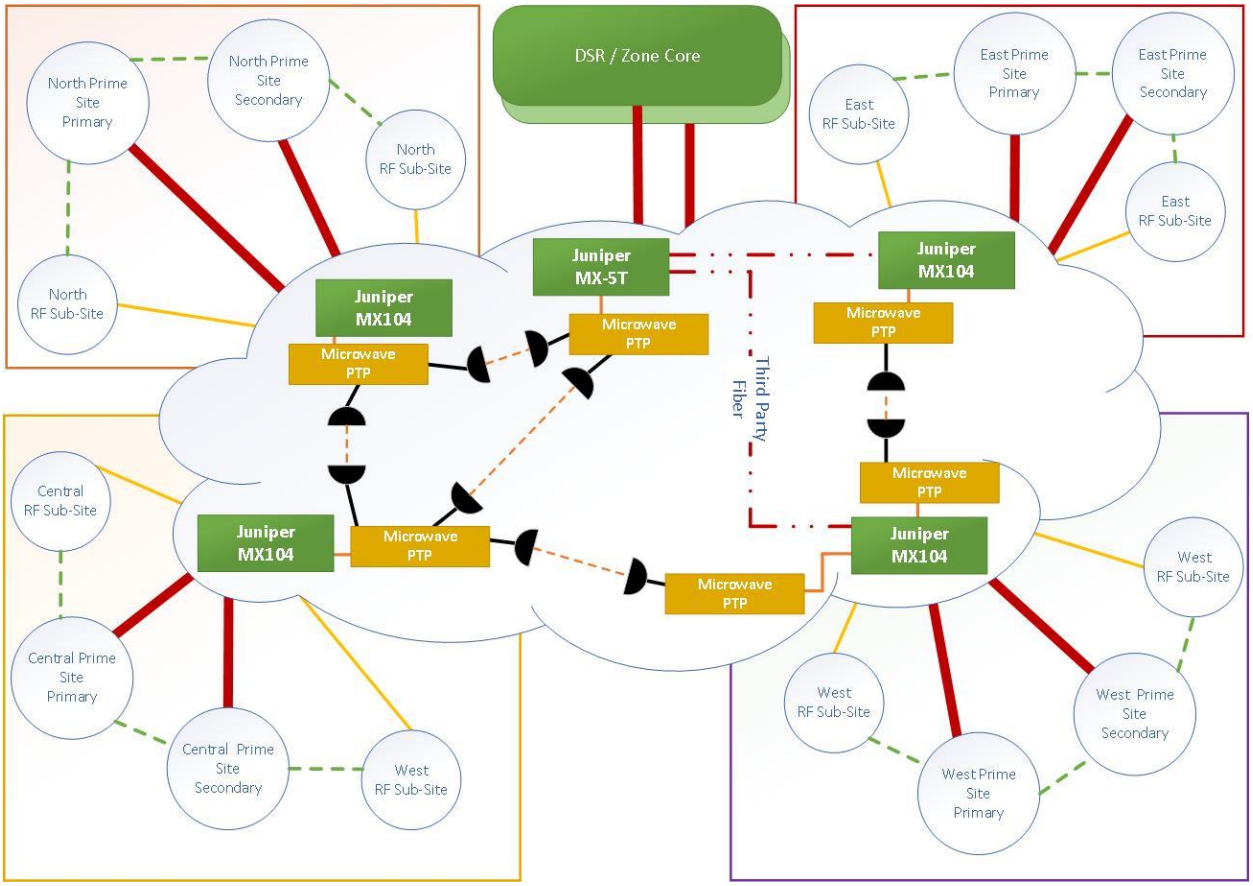


Figure 4: Customer Enterprise Network (CEN)/ Backhaul Network – General Backhaul Network Setup



3.1.1.2 Metrolinx radio system shall acquire the necessary materials to implement the radio system. This may include, coaxial cables, ethernet cables, SM fiber cable, power cords, and other devices, as well as tools and test equipment for installation. See figure 5 and figure 6.

Figure 5: Copper patch cable, coaxial cable, SM fiber cable, power cord, cable label

Figure 6: Network cable tools

3.1.1.3 Metrolinx radio system shall acquire the necessary test equipment to implement the radio system. This may include power meter, spectrum analyzer, digital multimeter, watt meter, radio tester, antenna analyzer. Metrolinx Radio Systems test equipment shall be maintained and calibrated regularly to manufacturer's specifications to ensure accuracy when performing preventative maintenance measures of RF sub-sites. See figure 7.

Figure 7: Radio system test equipment

a) R&S NRT-Z14 power sensor is a highly accurate and versatile tool for measuring RF power levels in a wide range of applications.

b) R&S FSH4 spectrum analyzer is a versatile tool that is ideal for use in a variety of field applications. It offers high performance and accuracy, making it a valuable tool for engineers and technicians in the telecommunications, broadcasting, and defense industries.

c) Fluke digital multimeter is a versatile tool for electrical and electronics engineers, technicians, and hobbyists. It provides accurate and reliable measurements of various electrical parameters and helps in troubleshooting and diagnosing electrical and electronics systems.

d) Bird watt meter is a valuable tool for measuring the power output of RF devices accurately. It helps engineers and technicians in the telecommunications, broadcasting, and aerospace industries ensure that their systems are operating correctly and safely.

e) Aeroflex 3920B is a versatile tool for testing and verifying the performance of a wide range of communication systems. It offers a variety of features, including support for multiple communication protocols, a built-in spectrum analyzer, and automated testing capabilities, making it a valuable tool for engineers and technicians in the telecommunications and aerospace industries.

f) Anritsu S331D Site Master is a valuable tool for testing and measuring the performance of RF systems in the field. It offers a variety of features, including cable and antenna analysis, DTF measurement, and spectrum

analysis, making it a versatile tool for telecommunications technicians and engineers.

3.1.1.4 Anritsu S412E LMR Master is a valuable tool for testing and measuring the performance of LMR systems in the field. It offers a variety of features, including channel and frequency scanning, spectrum analysis, and a rugged design, making it a versatile tool for public safety and emergency responders, as well as for commercial and military applications. Metrolinx Radio Systems shall install the components according to the layout plan. This may involve mounting the site controller, comparator, repeater, GPS, network router, network switch, combiner, monitoring, IDU, ATS, PDU, UPS and running cables, connecting devices, and configuring settings. See figure 8.

Figure 8: Metrolinx Radio System Rack Diagrams

3.1.1.5 Radio systems shall review the current layout of the battery and associated equipment to ensure that they accurately reflect the existing battery diagram in the Metrolinx radio system shelter. Verify the accuracy of the current layout by physically inspecting the battery and associated equipment to ensure that they match the information presented in the diagram. Identify any discrepancies between the existing battery diagram and the actual layout of the battery and associated equipment. If there are any discrepancies, document them and determine the best course of action to correct them. See figures 9 and 10.

Figure 9: Radio System Battery Diagram

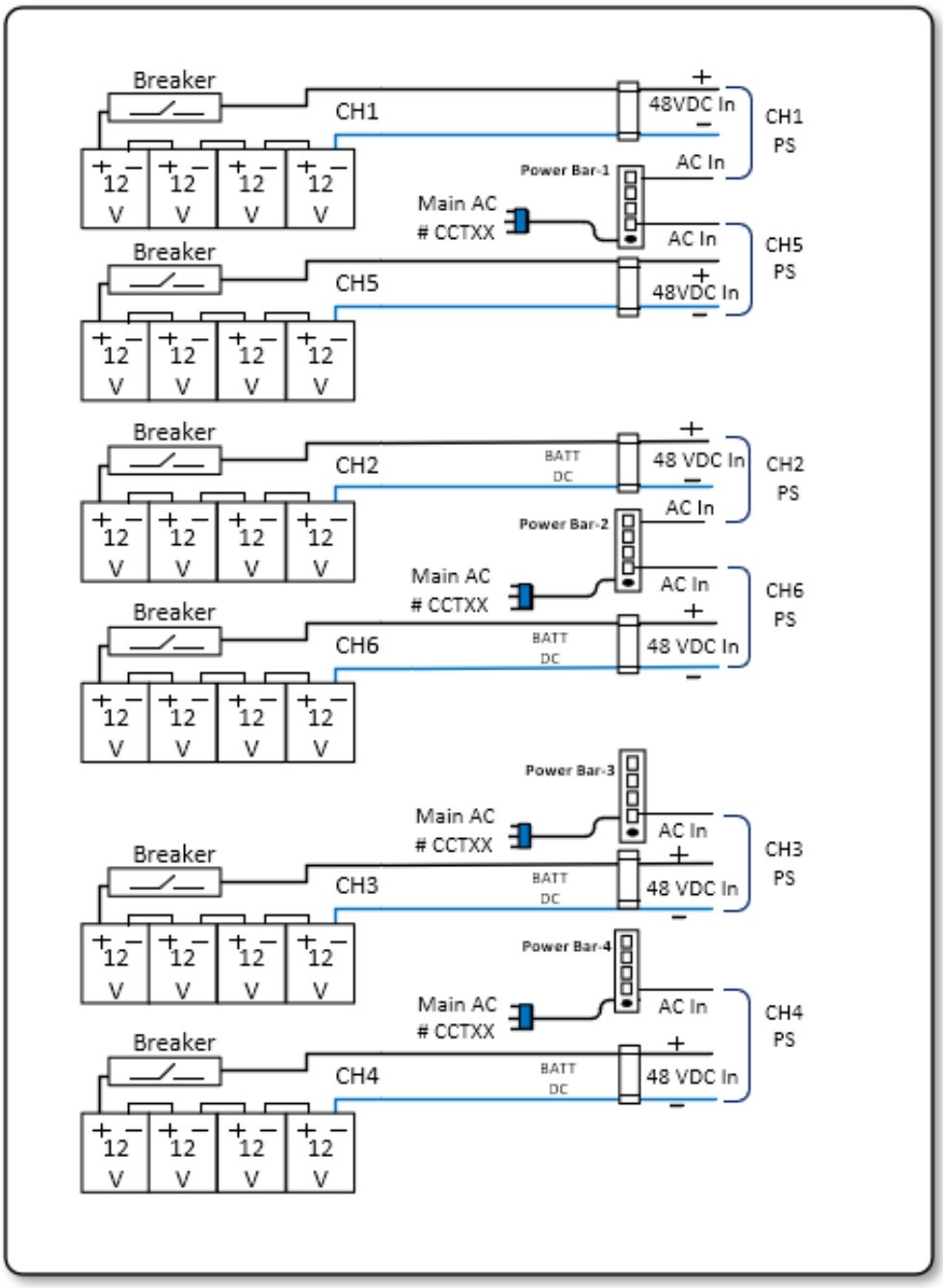


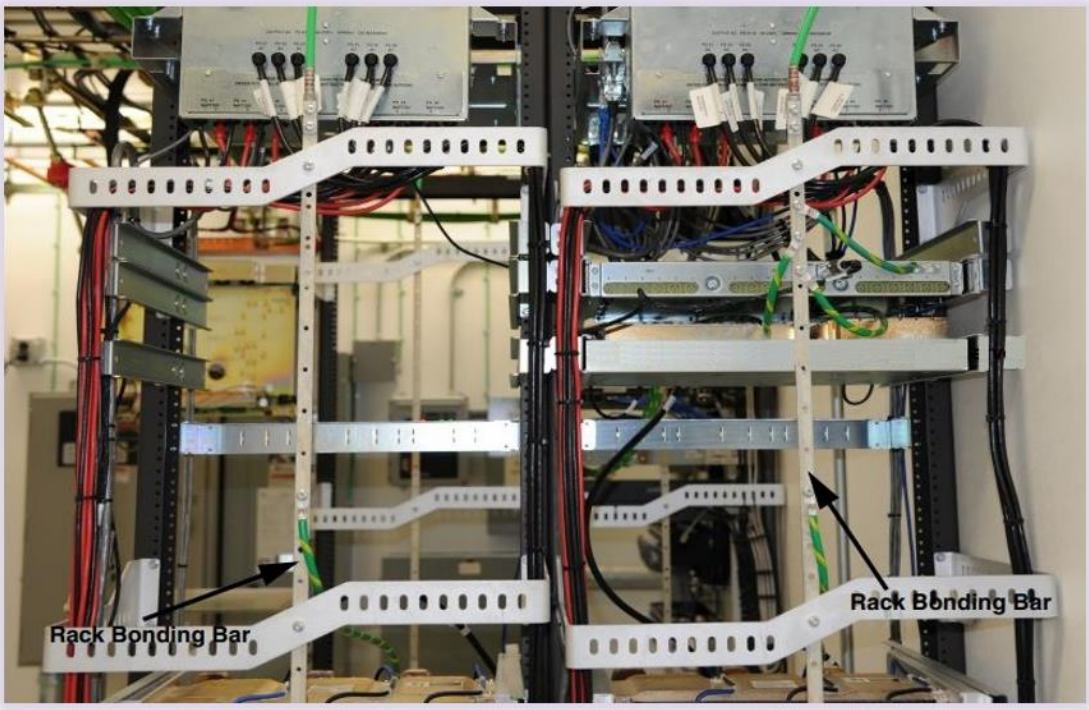
Figure 10: Battery Bank

3.1.1.6 The equipment racks shall be installed in the radio shelter, and the new radio equipment shall be mounted on the racks, ensuring that the equipment is secured properly to prevent any vibrations or damage during operation. See figure 11.

Figure 11: Radio Systems Rack

3.1.1.7 All equipment shall be properly grounded to prevent electrical interference and to ensure safety. See figure 12.

Figure 12: Grounding and Bonding Bar



3.2 Radio Equipment Installation

3.2.1 Installation of systems and equipment in an existing radio shelter involves preparing the space, procuring and preparing new equipment, connecting necessary cables, testing the equipment, and labeling and storing documentation with care.

3.2.1.1 The MOSCAD alarm panel shall be integrated into a Metrolinx radio shelter to provide a secure and reliable environment for remote monitoring and control of equipment and shall be configured to transmit alarm notifications and data in real-time. See figures 13, 14 and 15.

Figure 13: MOSCAD alarm panel

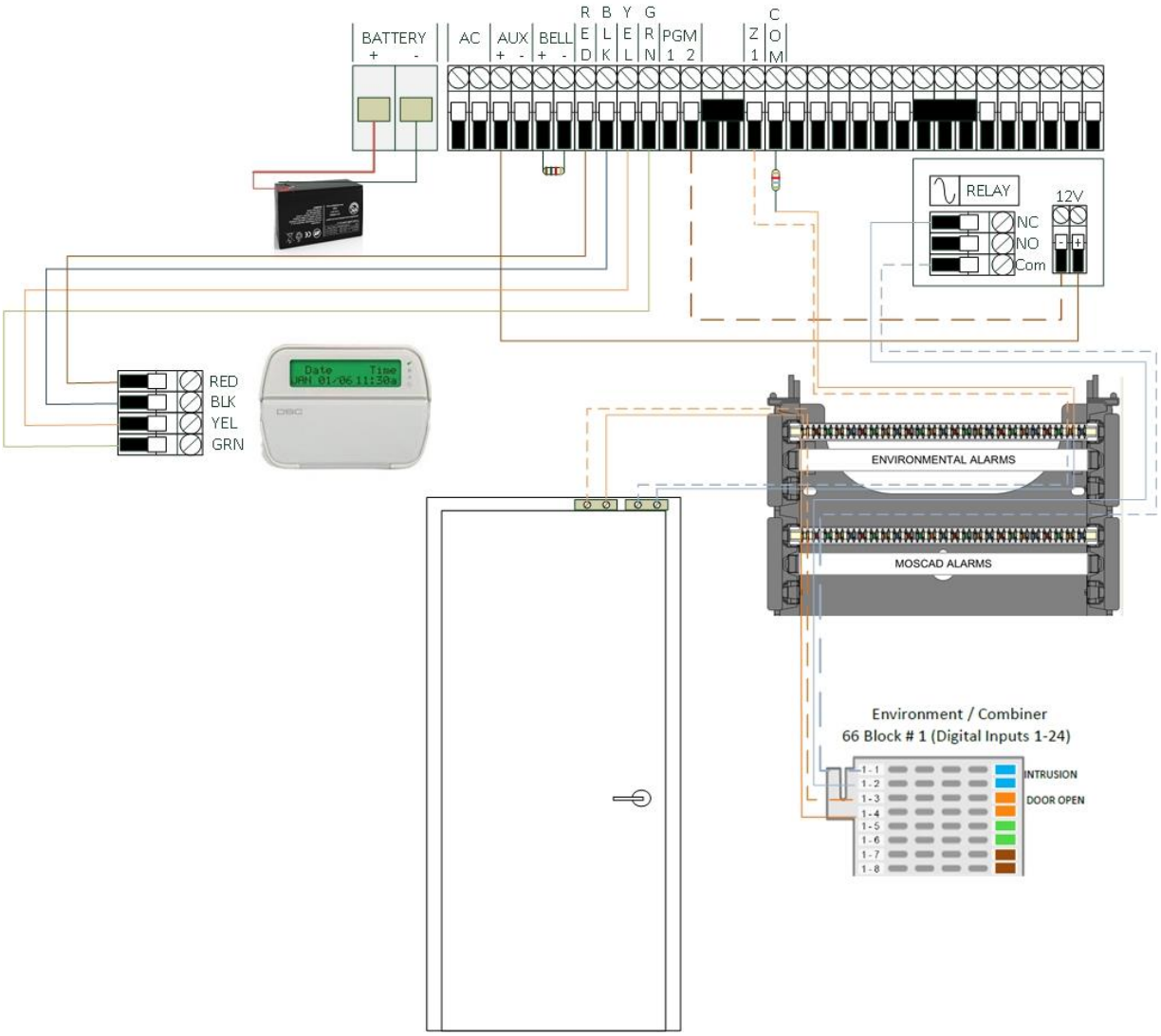


Figure 14: SDM3000 LED Panel Display, Rear Panel Ports

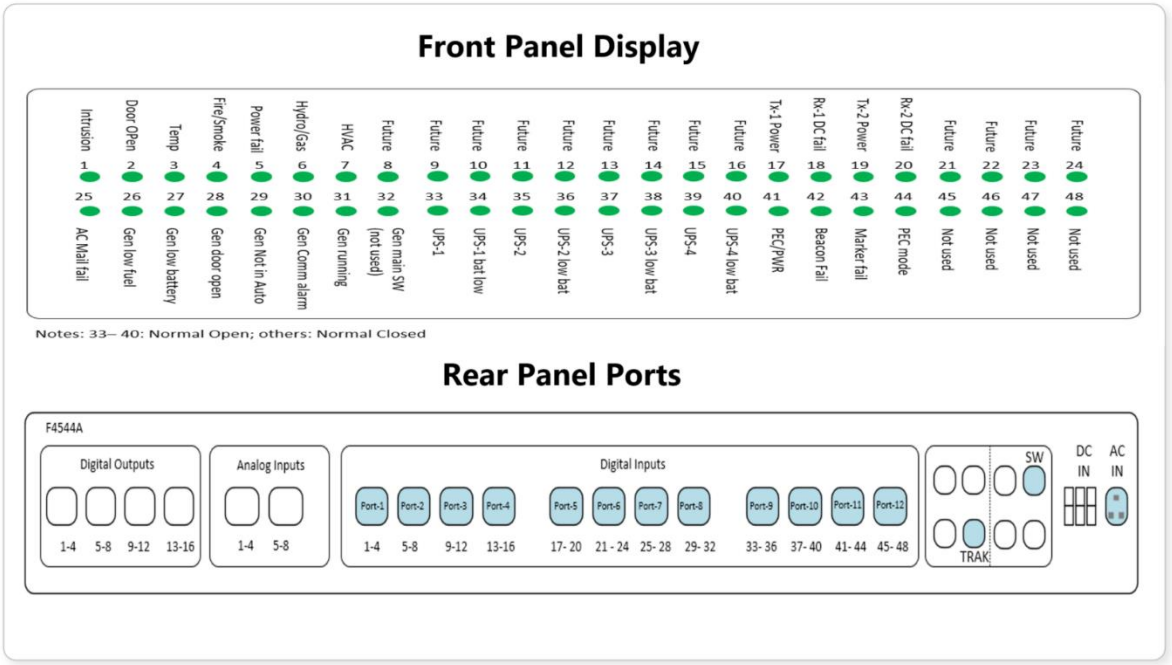


Figure 15: 66 block I and II

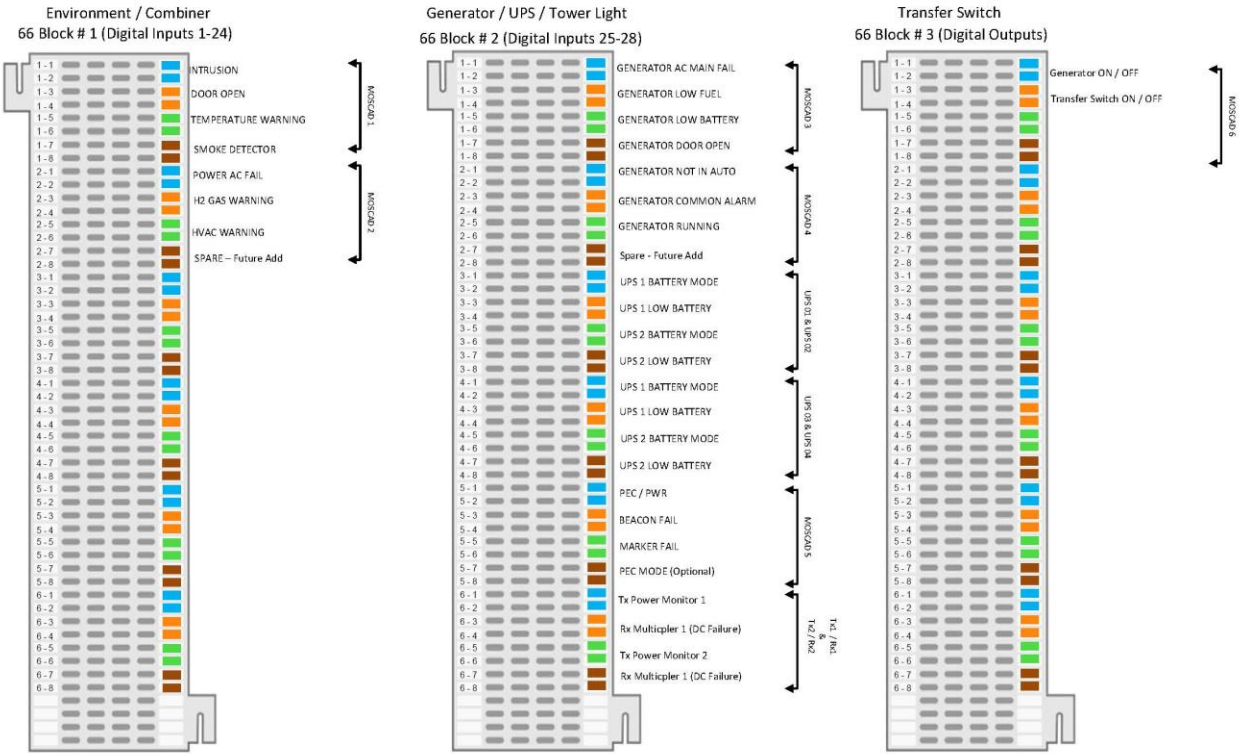
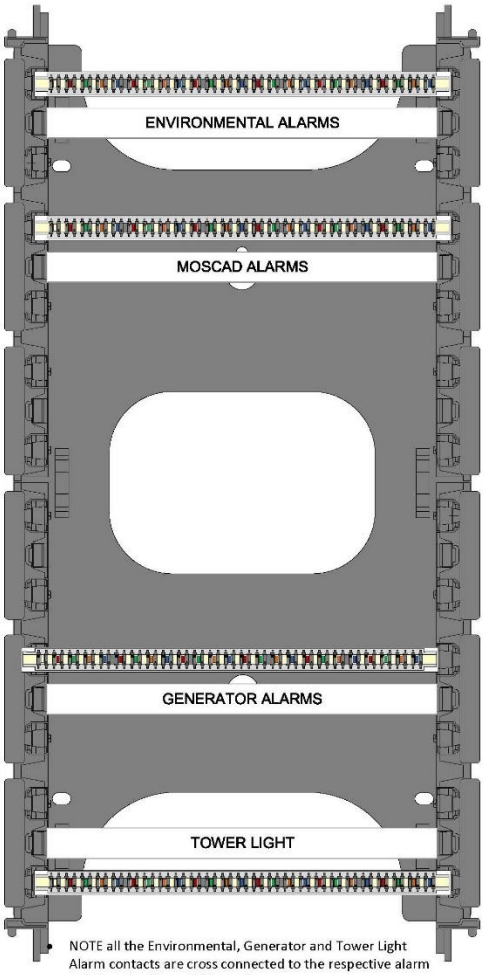


Figure 16: Bix block cross connect

BIX BLOCK CROSS CONNECT



- NOTE all the Environmental, Generator and Tower Light Alarm contacts are cross connected to the respective alarm point on the Moscad Bix comb.
- Also some sites DO NOT have Generators or Tower Light systems. Hence those alarm contacts will be shorted on the Moscad 66 Block.
- Non-shelter sites DO NOT monitor the HVAC units. But there are Hi/Lo Temperature Sensors. The HVAC warning alarm contact will be shorted on the Moscad 66 Block.

The Environmental Alarms include all the pre-wired alarm contacts on the site. The Alarm Contacts from left to right are:

- Door
- Smoke Detector
- Heat Detector
- AC Power Fail
- Gas Monitor
- High Temp
- Low Temp
- HVAC Power Fail
- HVAC Lockout

The MOSCAD Alarms are cabled from the Moscad 66 Block #1, 2 & 3. They include the Moscad alarm cables 1 – 6 which are the Environmental, Generator & Tower Light. Note each site varies as not all sites have a Generator and/ or a Tower Light system. The Alarm Contacts from left to right are:

- Intrusion
- Door open
- Temperature Warning (Hi/Lo temp)
- Fire/Smoke (Smoke & Heat Detector)
- AC Power Fail
- Hydrogen/Gas Warning
- HVAC Warning (HVAC Power fail & Lockout)
- Spare for Future (Not used)
- Gen AC Main Fail
- Gen Low Fuel
- Gen Low Battery
- Gen Door Open
- Gen not in Auto
- Generator Common Alarm
- Gen Running
- Main Transfer Switch Status
- PEC / PWR
- Beacon Fail
- Marker Fail
- PEC Mode (Optional)
- Generator On/Off
- Transfer Switch On/Off

The Generator Alarms include all the pre-wired alarm contacts from the Generator Annunciator & Transfer Switch. The Alarm Contacts from left to right are:

- Gen AC Main Fail
- Gen Low Fuel
- Gen Low Battery
- Gen Door Open
- Gen not in Auto
- Generator Common Alarm
- Gen Running
- Main Transfer Switch Status
- Generator On/Off
- Transfer Switch On/Off

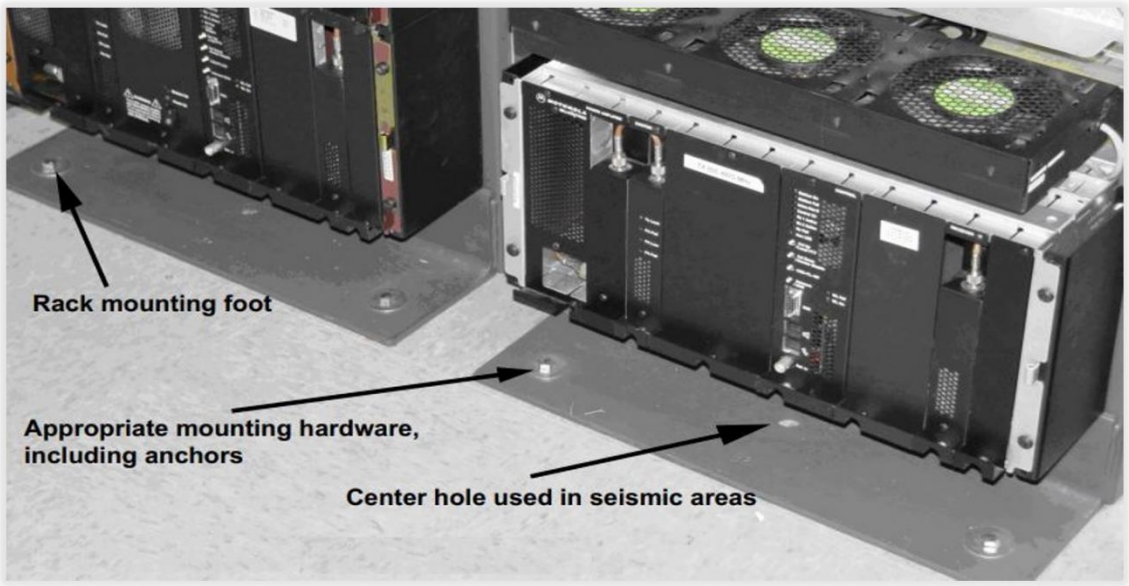
These alarm contacts are pre-wired directly from the Tower Light system. The alarm Contacts from left to right are:

- PEC / PWR
- Beacon Fail
- Marker Fail
- PEC Mode

3.2.1.2 Any necessary equipment and materials, such as cabling, connectors, and mounting hardware, shall be procured in advance of installation.

3.2.1.3 The equipment rack shall be installed as per design in the desired location, ensuring that it is level and properly secured and anchored. See figure 16.

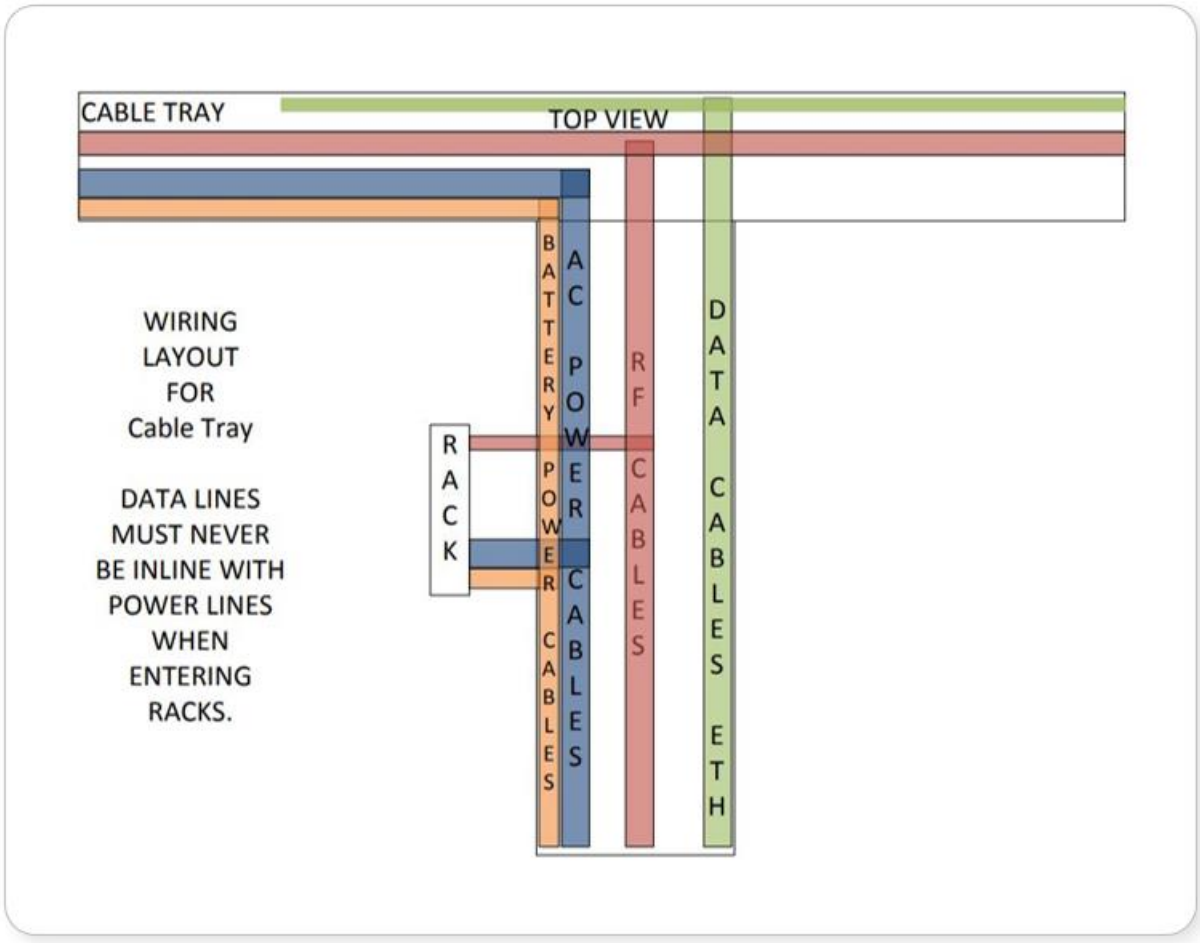
Figure 17: Anchor installation



3.2.1.4 The individual pieces of radio communication equipment shall be installed into the equipment rack, making sure to follow manufacturer's instructions and any relevant safety guidelines.

3.2.1.5 The cable tray in a UHF radio shelter shall be a structure designed to support and organize the cables necessary for the operation of the radio communication equipment. It shall typically consist of a series of horizontally mounted trays, each of which is equipped with a set of cable guides, brackets, and other components. Recommended distance between AC, RF, and Data cables is 6 inches between each cabling. If the cables must cross, they must cross perpendicularly, not parallel. Due to limited spacing in the cable tray, Data is kept as far away from AC cabling as possible. See Figure 17.

Figure 18: Cable Tray

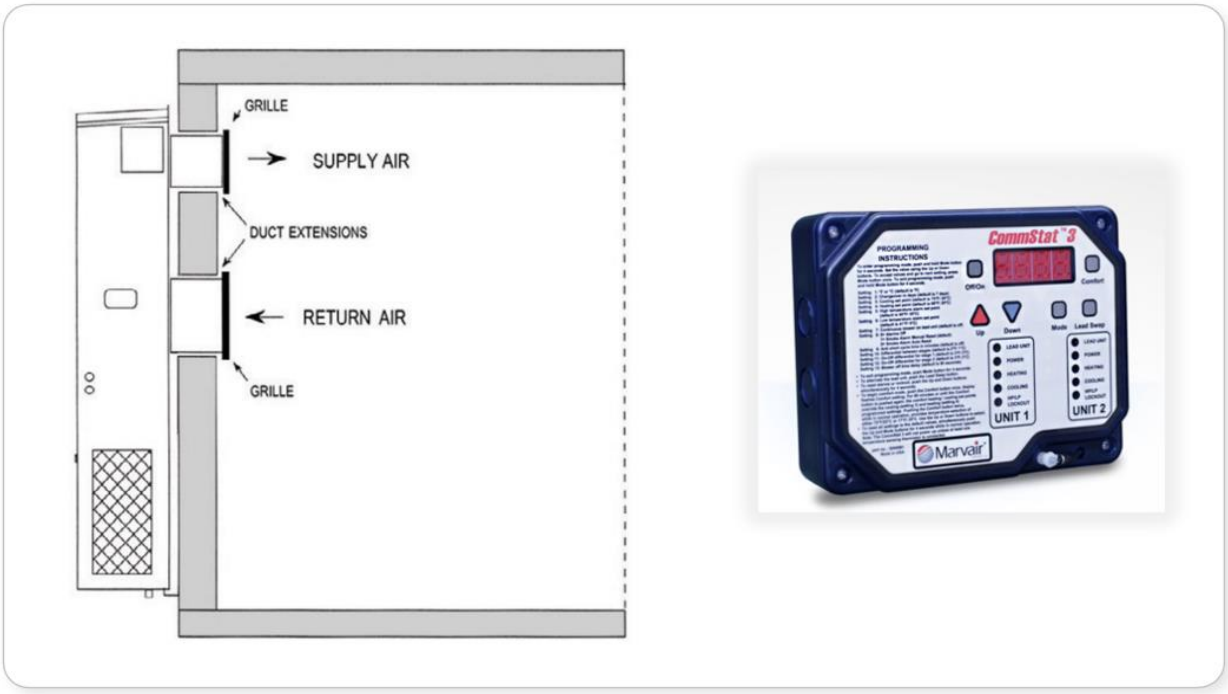


3.2.1.6 The wiring layout for racks in a Metrolinx radio shelter shall be a carefully planned system designed to ensure that each electronic component is properly connected to other components and that there is no interference or crosstalk between the different cables. It shall consist of a series of cable guides, connectors, and other components, as well as a neatly arranged and labeled set of cables. Recommended distance between AC, RF, and Data cables is 6 inches between each cabling. If the cables must cross, they must cross perpendicularly, not parallel. Due to limited spacing in the cable rack, Data is kept as far away from AC cabling as possible. See Figure 18.

Figure 19: Wiring Layout for Racks

3.2.1.7 The environmental controls in the Metrolinx radio shelter shall include air conditioning, heating, and ventilation systems, designed to maintain stable temperature and humidity levels within the shelter. The environmental controls shall be monitored and controlled remotely via a centralized management system, providing real-time status updates and alerts to ensure the safety of personnel and optimum performance of equipment. See figure 19.

Figure 20: Environmental Controls and Diagram



3.3 Radio power, battery and electrical connections

3.3.1 All power, backup battery, and electrical connections into an existing radio shelter involve ensuring that the site has an adequate power supply and backup battery system to support the new equipment. The electrical connections must be properly installed and grounded to prevent electrical hazards, and any necessary permits and regulations must be adhered to. If required, a licensed electrician shall install high-voltage sources.

3.3.1.1 Power supplies shall be rated for the specific equipment and properly sized to handle the design load. See Figures 20-22.

Figure 21: Radio systems Prime Site 6-channel transfer switch and UPS diagram

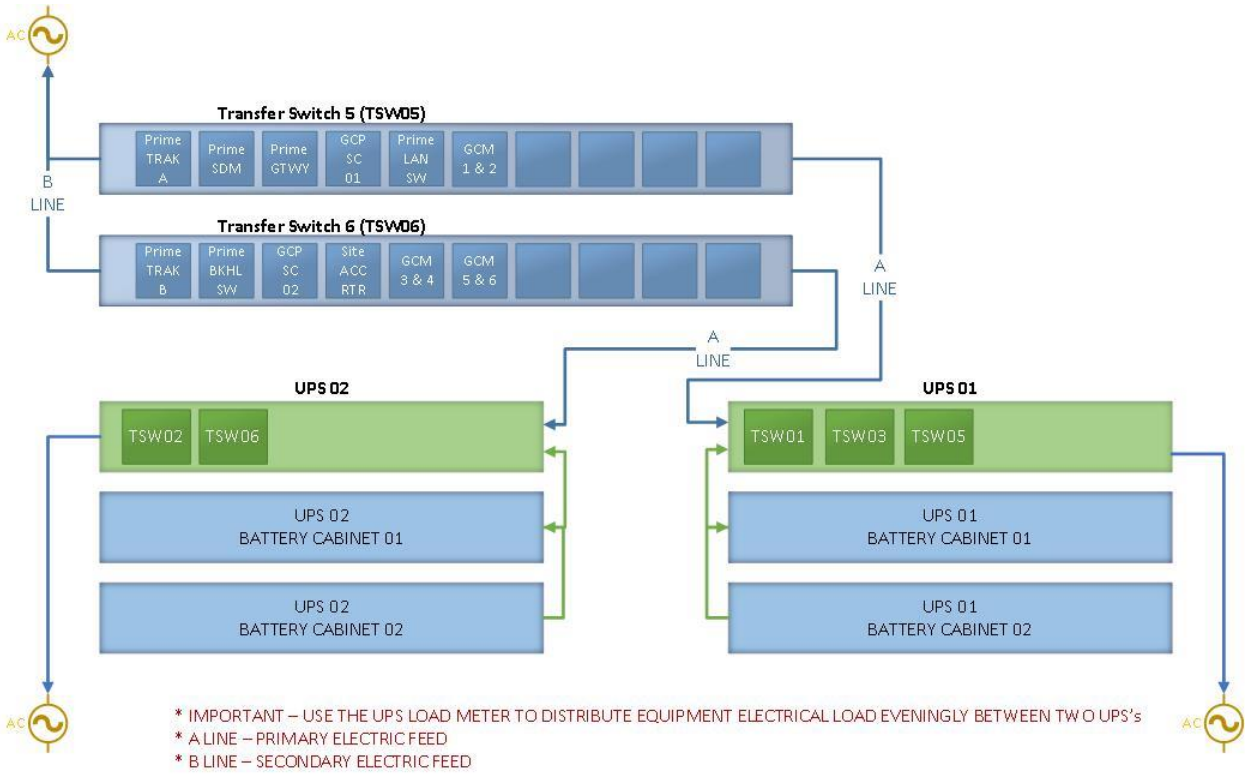


Figure 22: Radio systems Prime Site 12-channel transfer switch and UPS diagram

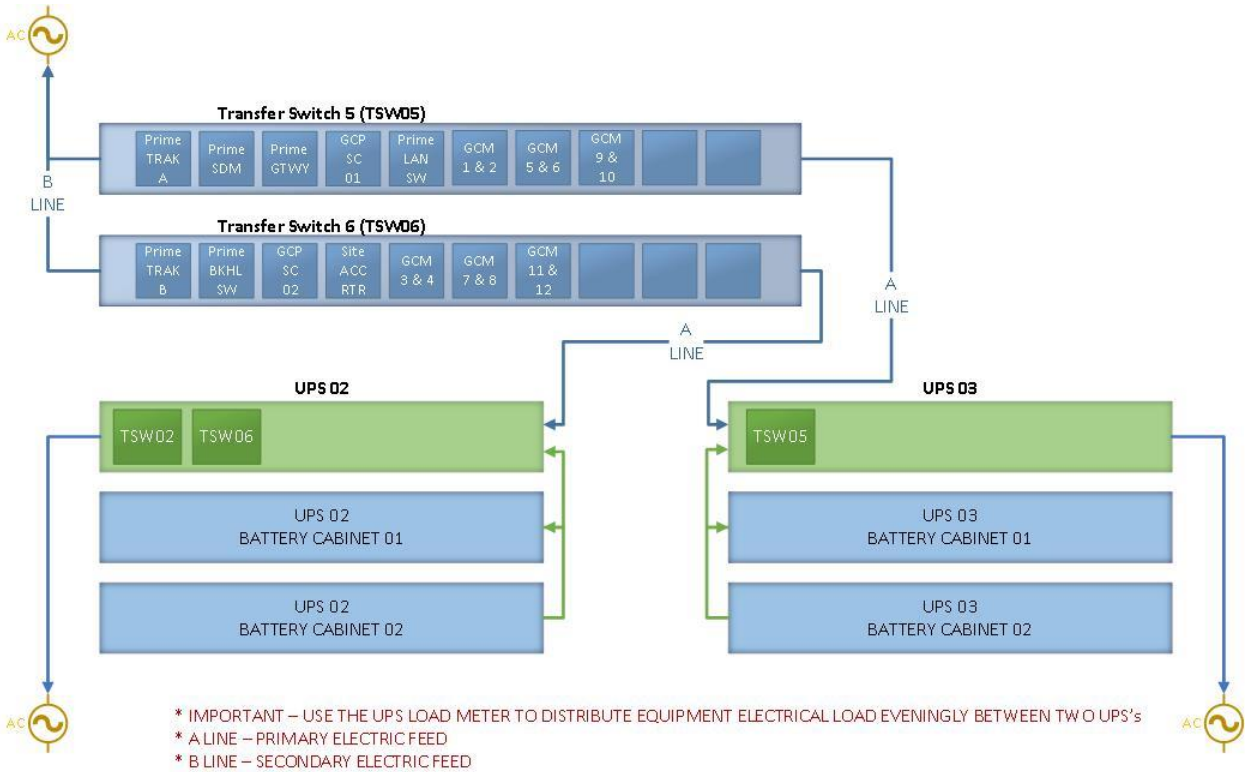
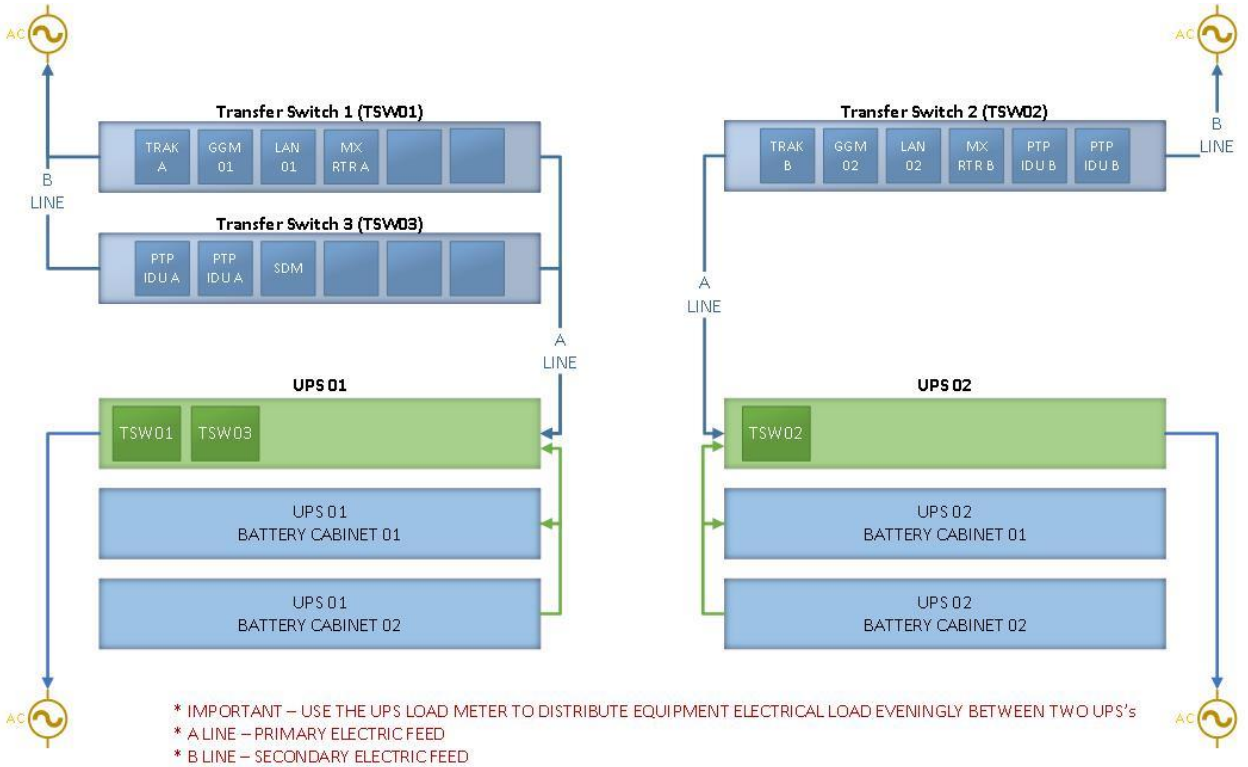


Figure 23: Radio systems sub-site transfer switch and UPS diagram

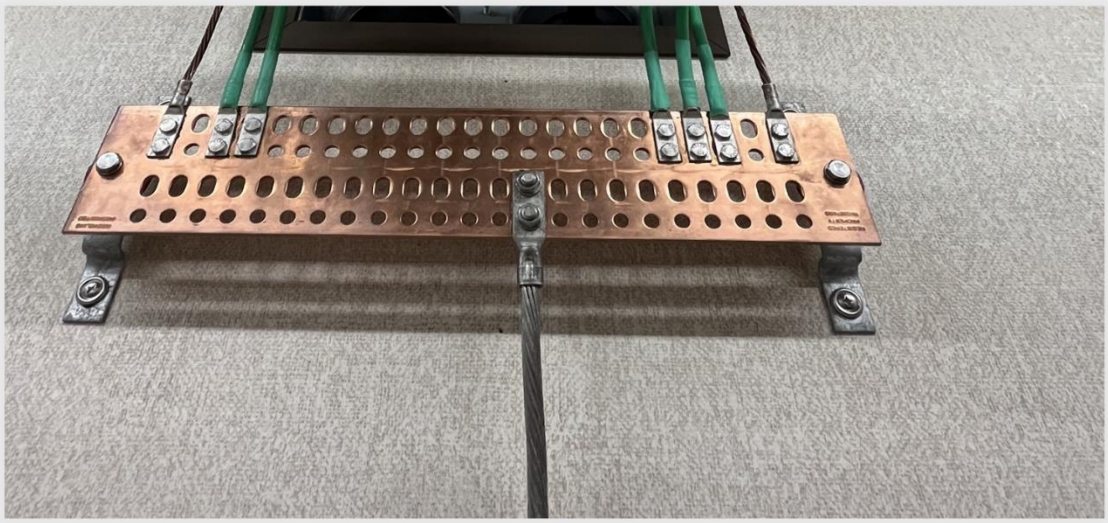


3.3.1.2 Power and grounding systems shall be installed to supply electricity to the new equipment and to protect against electrical interference.

3.3.1.3 All necessary connections, including power, data, and grounding connections, shall be made according to electrical code.

3.3.1.4 Electrical connections shall be securely terminated and tested for proper voltage and grounding. See figure 21.

Figure 24: Grounding



3.4 Site radio configuration and testing

3.4.1 All systems, equipment configuring and testing radio communication equipment, such as radios, to ensure optimal performance, reliability, and compliance with industry regulations. The configuration process includes setting up the radios and other equipment to work optimally and securely, and the testing process involves measuring the signal strength, range, and quality to ensure that the equipment is performing as expected. This testing is crucial to ensure that the equipment is secure and reliable, and that it meets the necessary regulations for safe and effective communication. The guidelines for radio configuration and testing are essential to guarantee that Metrolinx radio communication equipment is functioning correctly and providing reliable communication.

3.4.1.1 Metrolinx radio shall be configured with the appropriate transmit and receive frequencies, power levels, and modulation types as specified by the system design.

3.4.1.2 Metrolinx radio shall be programmed with the appropriate security features, such as password protection or encryption, as required by the system design.

3.4.1.3 Metrolinx radio systems be tested for frequency accuracy using a calibrated frequency counter or spectrum analyzer. See figure 7.

3.4.1.4 Metrolinx radio shall be tested for output power using a calibrated wattmeter or power meter. See figure 7.

3.4.1.5 Metrolinx radio shall be tested for both transmit and receive range using various power levels and antenna configurations.

3.4.1.6 Metrolinx radio systems shall be tested to ensure compliance with RF energy exposure standards as outlined in Safety Code 6.

3.5 Site radio documentation and maintenance

3.5.1 All documentation includes creating site plans, equipment configurations, test results, and other relevant information to provide a comprehensive record of the installation process. Maintenance involves establishing a plan for ongoing monitoring and upkeep of the equipment, including routine inspections, cleaning, and repairs. These standards ensure that the radio communication equipment is kept in optimal condition, so that it can provide reliable and uninterrupted communication. Proper site documentation and maintenance are crucial to ensure the long-term performance and safety of radio communication equipment.

3.5.1.1 Metrolinx radio systems installations and maintenance activities shall be thoroughly documented, including equipment specifications, installation procedures, and any changes or modifications made.

3.5.1.2 Accurate records of all installation details, including equipment specifications, test results, and compliance with regulatory requirements, shall be kept by Metrolinx.

3.5.1.3 All Metrolinx radio installation procedures shall be performed in accordance with recognized safety standards and guidelines, including those published by the Occupational Health and Safety Act (OHSA) and other regulatory agencies.

3.5.1.4 All Metrolinx radio installations shall comply with regulatory requirements and industry standards, including those published by the International Electrotechnical Commission (IEC) and the National Fire Protection Association (NFPA).

3.6 Site inspection and access

3.6.1 All inspection process involves regular checks to ensure that the equipment is functioning correctly and that the site is secure, with appropriate signage and barriers in place. Control access procedures must also be established to ensure that only authorized personnel have access to the site, and that the equipment is protected against theft or tampering. These standards help to ensure the safety and security of radio communication equipment sites, as well as the reliability and uninterrupted services provided by the equipment.

3.6.1.1 Metrolinx radio systems personnel shall verify visitors' and contractors' identity and purpose of access to the site and provide relevant documentation such as job safety

analysis (JSA) work at heights rescue plan, site specific emergency response plan, and first aid training certificate.

3.6.1.2 Metrolinx radio systems shall provide to site-specific access protocols and follow any applicable security measures, such as badge or keycard access, signing in and out, or escort requirements. Additionally, the designated Radio Systems specialist shall ensure that all access points are properly secured and remain secure during their visit.

3.6.1.3 Metrolinx radio systems personnel, visitors, and contractors shall follow all safety procedures and guidelines during site visits. This includes the mandatory use of personal protective equipment (PPE) such as hard hats, safety glasses, and harnesses, as well as ESD wristbands, ESD shoes, and anti-static bags for equipment parts or modules to prevent electrostatic discharge (ESD) buildup.

3.6.1.4 Metrolinx radio systems shall document the results of the site preventive maintenance, including any identified issues, their severity, and recommended corrective actions. The findings shall be reported to the appropriate parties e.g., supervisor for necessary action. See figure 22.

Figure 25: Site Preventive Maintenance Form

GO Transit Radio System Preventative Maintenance

SITE NAME:
SITE ID:
LOCATION:
DATE:
SPECIALISTS:

Site Desense A:
Site Desense B:
Tx Loss (RFDS) =
RxA Gain (RMC) = 11 db
RxB Gain (RMC) = 11 db
Iso-Tee: A=-30db B=-30db
Site Noise A:
Site Noise B:

Base Radio	1	2	3	4	5	6	Unit
IP Address	184.x.xxx.1	184.x.xxx.2	184.x.xxx.3	184.x.xxx.4	184.x.xxx.5	184.x.xxx.6	
Tx Frequency	410.3125	411.1125	413.3375	411.4875	413.9375	411.7875	MHz
Rx Frequency	415.3125	416.1125	418.3375	416.4875	418.9375	416.7875	MHz

CSS Verification (Remotely or Locally)							
RF Channel	1	2	3	4	5	6	Unit
Programmed Power							W
Actual Power							W
Battery Voltage							V
Current drawn when Txing							A
Base Radio TDMA Transmitter Tests							
Tx Test Internal							P/F
Wattmeter Reading from base radio							W
Wattmeter Reading to Antenna (RFDS)							W
Reverse Power measured from Antenna							W
Frequency Error							Hz
Tx BER							%
Modulation Fidelity							%
Symbol Deviation							Hz
Symbol Rate Accuracy							mHz
Base Radio TDMA Receiver Tests							
Rx Test Internal							P/F
RSSI Direct A (To base radio ant port A)							dBm
RSSI Direct B (To base radio ant port B)							dBm
Rx BER Calibrate A							%
Rx BER Calibrate B							%
Rx BER Floor A							%
Rx BER Floor B							%
Gen Level Sensitivity A							dBm
Gen Level Sensitivity B							dBm

Power Source Testing/ Verifications							
Back-up battery voltage (Off Load)	0.0	0.0	0.0	0.0	0.0	0.0	V
Back-up battery voltage (On Load)							V
Curent Drawn On Load							A

NOTES/ COMMENTS

Checked functionality for main and backup units.
Manually switched GPS reference from position A to B.
Disconnected GTR AC power to observe continuous battery supply.
Verified report on UEM.

3.6.1.5 Metrolinx radio systems shall inspect all radio site equipment, including antennas, cables, transmitters, and receivers, and assess their condition, functionality, and compliance with relevant standards, they shall perform a site assessment, inspecting the physical environment and identifying any potential hazards that could affect the radio site or the safety of those accessing the site. See figure 23.

Figure 26: Site Inspection Checklist

METROLINX

Monthly Radio Site Inspection Check List

Site:
Date:
Inspected by:

Task	Notes	Status	Action Taken
Compound Visual Inspection:			
• Check locks and gates for physical damage or deterioration			
• Check the fence for any sign of vandalism or damages.			
• Check fence /gate groundings condition.			
• Check landscaping and or snow cleaning. Apply salt if needed.			
Radio Shelter Visual Inspection:			
• Check for signs of corrosion and leakage outside and inside			
• Check front door light			
• Check the cable tower entry is sealed properly			
• Look for any signs of infestation or animal damages			
• Visually inspect the equipment			
• Inspect fire extinguisher and fill the tag attached to it.			
• Check Commstat and HVAC			
• Check the shelter is cleaned and in order			
• Check First Aid Kit condition			
• Check eyewash for tampering and expiration date			
Generator Inspection			
• Check fuel level			
• Check for signs of corrosion, damage or infestation			
Tower Visual Inspection			
• Check tower base/legs for damages/cracks			
• Inspect cable tray from tower to the shelter			
• Check tower lights are working			
• Check antennas and MW dish for visual damages			
• Check tower groundings condition			
Comments and Suggestions			