NCVET
कौशल गुणवत्ता प्रगति

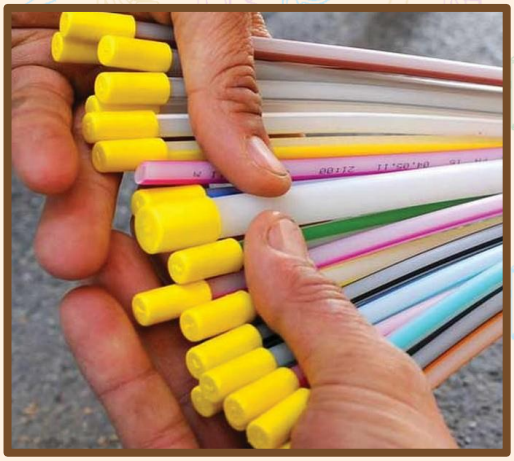
Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

Telecom Sector Skill Council

Facilitator Guide



Sector
Telecom

Sub-Sector
Network Managed Services

Occupation
Network (Active Components Installation)

Reference ID: **TEL/Q6213,** Version **3.0**
NSQF Level **4**

Technician 5G - Active Network Installation

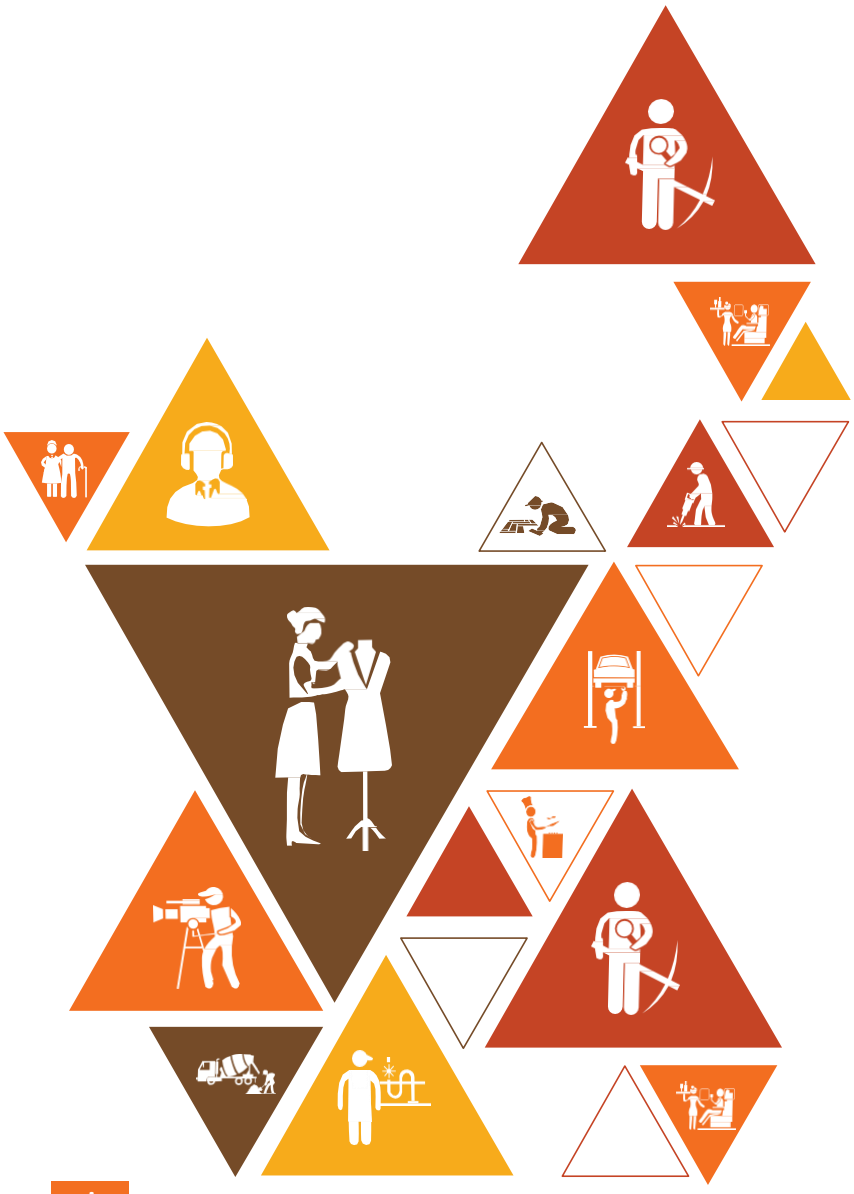
This book is sponsored by
Telecom Sector Skill Council
Estel House,3rd Floor, Plot No: - 126, Sector-44
Gurgaon, Haryana 122003
Phone: 0124-2222222
Email: tssc@tsscindia.com
Website: www.tsscindia.com

Disclaimer

The information contained herein has been obtained from sources reliable to Telecom Sector Skill Council. Telecom Sector Skill Council disclaims all warranties to the accuracy, completeness or adequacy of such information. Telecom Sector Skill Council shall have no liability for errors, omissions, or inadequacies, in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be grateful for any omissions brought to their notice for acknowledgements in future editions of the book. No entity in Telecom Sector Skill Council shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by the Telecom Sector Skill Council.

"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India



Acknowledgements

Telecom Sector Skill Council (TSSC) would like to thank all the individuals and institutions who contributed in various ways towards the preparation of this facilitator guide. The facilitator guide could not have been completed without their active contribution. Special gratitude is extended to those who collaborated during the preparation of the different modules in the facilitator guide. Wholehearted appreciation is also extended to all who provided peer review for these modules.

The preparation of this guide would not have been possible without the Telecom Industry's support. Industry feedback has been extremely beneficial since inception to conclusion and it is with their guidance that we have tried to bridge the existing skill gaps in the industry. This facilitator guide is dedicated to the aspiring youth, who desire to achieve special skills which will be a lifelong asset for their future endeavours.

About this Guide

The facilitator guide (FG) for Technician 5G – Active Network Installation is primarily designed to facilitate skill development and training of people, who want to become professional Technician 5G – Active Network Installations in various stores. The facilitator guide is aligned to the Qualification Pack (QP) and the National Occupational Standards (NOS) as drafted by the Sector Skill Council (TSSC) and ratified by National Skill Development Corporation (NSDC).

It includes the following National Occupational Standards (NOSs)-

1. TEL/N6104: Carry out Rack Level Installation
2. TEL/N6105: Carry out 5G active network installation
3. TEL/N6246: Follow the Occupational Health and Safety Instructions during Tower Climbing
4. TEL/N9105: Follow sustainable practices in telecom infrastructure installation
5. DGT/VSQ/N0102: Employability Skills (60 Hours)

Post this training, the participants will be able to perform tasks as professional Assistant Technician (Wireless). We hope that this Facilitator Guide provides a sound learning support to our young friends to build a lucrative career in the Telecom Skill Sector of our country.

Symbols Used

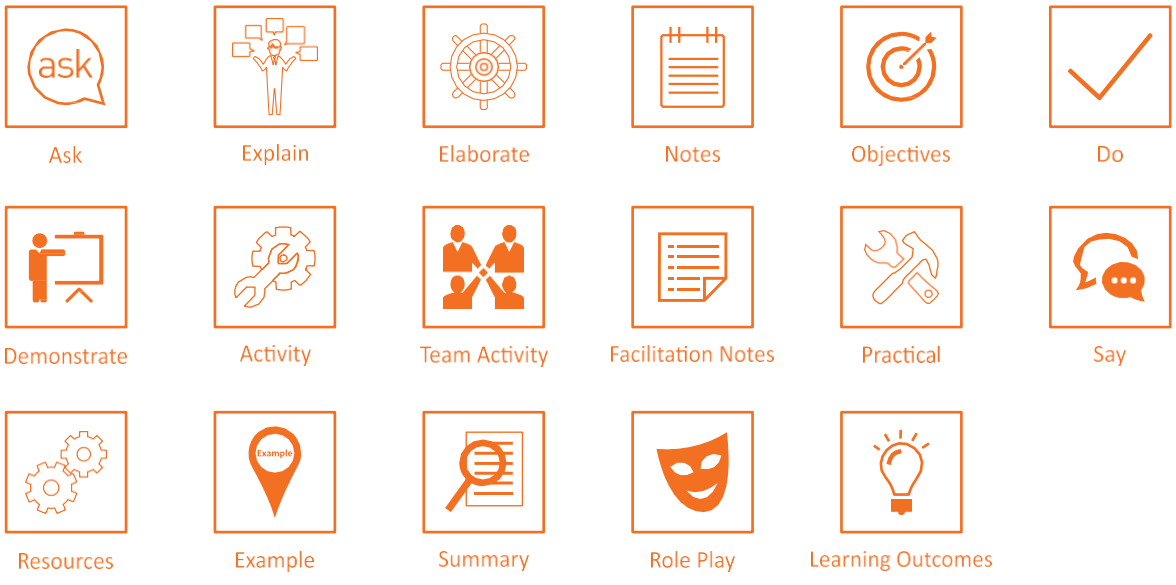
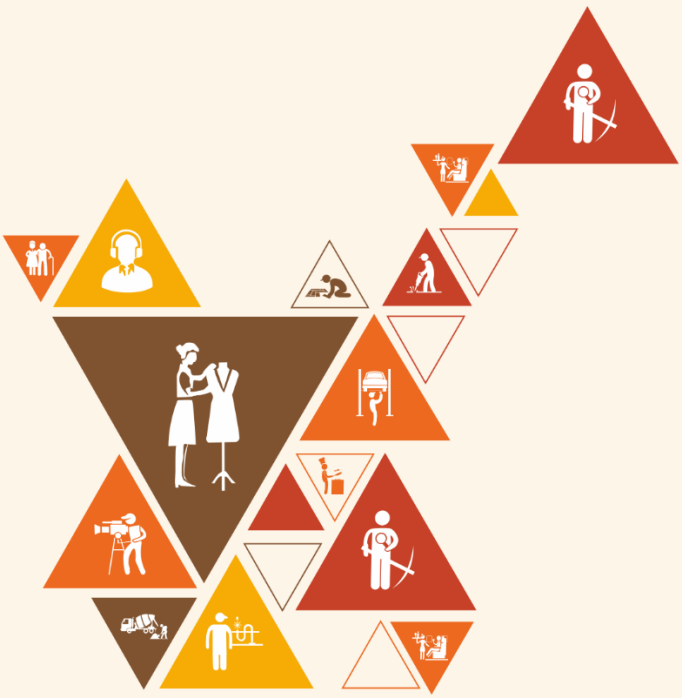


Table of Contents

It is recommended that all trainings include the appropriate Employability skills Module. Content for the same is available here: **https://www.skillindiadigital.gov.in/content/list**

1. Introduction to the Sector and the Job Role of a Technician 5G - Active Network Installation

Unit 1.1 - Introduction to Telecom Sector and Role of a Technician 5G - Active Network Installation



TEL/N6104

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the importance of Telecom Sector.
2. Discuss the roles and responsibilities of a Technician 5G - Active Network Installation.

UNIT 1.1: Introduction to Telecom Sector and Role of a Technician 5G - Active Network Installation

Unit Objectives

After the completion of this unit, participants will be able to:

1. Discuss the role of a Technician 5G - Active Network Installation in deploying, maintaining, and troubleshooting 5G active network infrastructure.
2. Describe the key components of 5G active network infrastructure, including base stations, antennas, backhaul equipment, and rack systems.
3. Identify the different components involved in 5G network deployment, such as RF cabling, power installations, and backhaul connectivity.
4. Elucidate the importance of 5G network performance metrics, such as signal strength, throughput, latency, and cell coverage, in ensuring optimal service quality.
5. Explain the importance of technical communication skills in coordinating with network engineers, site personnel, and other stakeholders during 5G network installation and troubleshooting.
6. Discuss safety protocols for tower climbing, handling RF equipment, and working with electrical systems during 5G network installations, including the use of appropriate PPE.
7. Describe the career advancement opportunities available for a Technician 5G - Active Network Installation in the expanding 5G telecommunications sector.

Resources to be Used

Participant Handbook, Presentation slides or visual aids, Handouts or reference materials on the job role of a 5G Technician, Whiteboard or flipchart with markers, Laptop or computer for presentation, Projector or screen for displaying slides, Internet access (if needed for live demonstrations or additional resources)

Activity

1. **Name of the activity:** Name Game (Ice Breaker)
2. **Objective:** This activity is focused on breaking the ice between the participants so that they can come up confidently in putting forward their opinion
3. **Type of activity:** Group activity
4. **Resources:** Participant Handbook, Pen, Notebook, Writing Pad, etc.
5. **Duration of the activity:** 60 minutes
6. **Instructions:**
   - Arrange the class in a semi-circle/circle
   - Say your name aloud and start playing the game with your name.
   - Say, “Now, each of you shall continue with the game with your names till the last person in the circle/ semi-circle participates”.
   - Listen to and watch the trainees while they play the game.
   - Ask questions and clarify if you cannot understand or hear a trainee.
   - Discourage any queries related to one’s financial status, gender orientation or religious bias during the game
   - Try recognising each trainee by their name because it is not recommended for a trainer to ask the name of a trainee during every interaction
1. **Outcome:** This activity has focused on breaking the ice between the participants so that they can come up confidently, putting forward their opinion.

Say

- Participants welcome to the session of Job Role 5G Technicians.
- We will understand the job role of a 5G Technician and the responsibilities and challenges associated with it.

Ask

- What are some of the sub-sectors within the telecom industry?
- Can you name a few responsibilities of a 5G Technician?
- Why is it important for a 5G Technician to stay updated with emerging technologies?

Do

- Present an overview of the size of the telecom industry and its sub-sectors.
- Discuss the role and responsibilities of a 5G Technician, focusing on their involvement in the installation, maintenance, and troubleshooting of 5G networks and equipment.
- Explain the daily, weekly, and monthly operations/activities that take place at the site under a 5G Technician, highlighting tasks such as network monitoring, maintenance, and customer support.
- Discuss the responsibilities and challenges faced by 5G Technicians, including network reliability, performance optimization, and staying updated with emerging technologies.

Elaborate

5G technician's roles and responsibilities:

- Discuss the size of telecom industry and its sub sectors
- Explain the role and responsibilities of a 5G technician
- Explain the daily, weekly, monthly operations/activities that take place at the site under a 5G technician
- Make a list of the responsibilities and challenges of a 5G technician
- Make a list of the requirements of computer networks, connections, and cabling in 5G installation
- Discuss the software testing, configuration, hardware, and peripheral device maintenance and repair works done by a 5G technician

Demonstrate

Perform a demonstration showcasing the process of software testing and configuration related to 5G equipment, if feasible. Show examples of how a 5G Technician would handle such tasks.

Activity

1. **Name of the activity:** Role Play a Day in the Life of a 5G Technician
2. **Objective:** To simulate the responsibilities and challenges faced by a 5G Technician in a realistic scenario.
3. **Type of activity:** Group
4. **Resources:** Scenario handouts, pens, paper.
5. **Time Duration:** 30 minutes
6. **Instructions:**
    - Divide participants into small groups of 4-5 individuals each.
    - Distribute the scenario handouts to each group.
    - Instruct each group to read the scenario and assign roles to each group member, such as a 5G Technician, customer, and supervisor.
    - Allow time for the groups to discuss and plan how they would handle the situation described in the scenario, considering the responsibilities and challenges of a 5G Technician.
    - Allocate 20 minutes for group discussions and preparation.
    - Once the groups are ready, have them perform their role-plays, portraying the interactions between the 5G Technician, customer, and supervisor.
    - Encourage other groups to provide feedback and engage in discussions after each role-play.
    - Facilitate a debriefing session, highlighting the key learnings and insights from the activity.
7. **Outcome:** Participants actively engage in a role-play activity that simulates the job role of a 5G Technician and allows them to apply their knowledge in a practical scenario.

Notes for Facilitation

- Ensure a supportive and inclusive learning environment throughout the session.
- Encourage participants to ask questions and share their experiences or insights related to the topic.
- Provide additional examples or case studies to enhance understanding.
- Emphasize the importance of continuous learning and professional development in the field of 5G technology.
- Be prepared to address any technical questions or concerns raised by participants.

Exercise

Answers to exercises for PHB

A. Short Answer Questions:

1. The primary responsibilities of a Technician 5G in active network installation include installing, configuring, and testing 5G radios and baseband units, aligning antennas, ensuring proper RF connectivity, performing site integration, and verifying network performance.
2. Key components of 5G active network infrastructure include antennas, RRUs/AAUs (Remote Radio Units/Active Antenna Units), BBUs (Baseband Units), backhaul equipment, power systems, and network management systems.
3. Monitoring performance metrics like signal strength and latency is crucial because it ensures consistent service quality, helps identify network issues quickly, and maintains optimal user experience in high-speed, low-latency 5G networks.
4. Safety precautions include:

- Using a full-body safety harness while climbing towers
- Wearing proper PPE such as helmet, gloves, and safety shoes
- Ensuring RF equipment is powered off or maintaining safe distance from active antennas
- Following lockout–tagout procedures and weather-related safety guidelines

5. A Technician 5G can advance to roles such as Senior RF Engineer, Network Operations Specialist, or 5G Field Supervisor.

B. Multiple Choice Questions:

1. b) Base stations
2. b) Time delay in data transmission
3. b) Backhaul
4. b) Technical communication
5. d) Both a and c

C. Fill in the Blanks

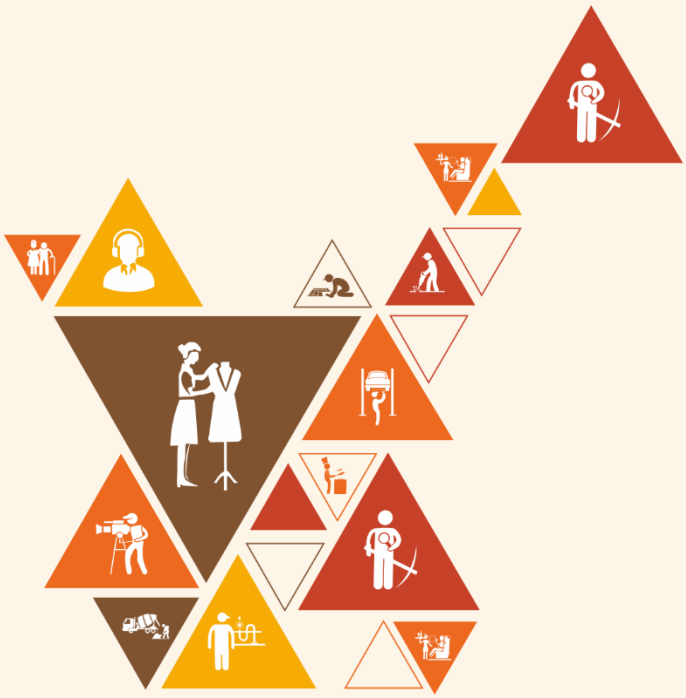
1. Antenna / RRU / AAU (Acceptable: Antenna)
2. Throughput / Data speed (Acceptable: Throughput)
3. Personal Protective Equipment (PPE)
4. RF cables / Feeder cables
5. Network coverage

Notes

2. Carry out Rack Level Installation

Unit 2.1 - Installation of Wi-Fi System

Unit 2.2 - Complete Documentation



TEL/TEL/N6104

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain how to prepare for the installation of racks and equipment for 5G networks.
2. Describe the process to install and secure racks and equipment for 5G networks.
3. Discuss the steps involved in post-installation verification and troubleshooting for 5G networks.

UNIT 2.1: Preparing and Installing Racks and Equipment for 5G Networks

Unit Objectives

After the completion of this unit, participants will be able to:

1. Explain the types, dimensions, and load ratings of racks used for IT and 5G network equipment installation.
2. Describe the standard dimensions and specifications of 5G network components, including gNodeB, switches, and routers.
3. Explain key rack components such as mounting rails, doors, ventilation panels, and cable management accessories.
4. Discuss the criteria for selecting an optimal installation space, including environmental, structural, and electrical factors.
5. Describe methods for evaluating power circuit capabilities, including voltage, amperage, and redundancy.
6. Elucidate the importance of effective cooling solutions and airflow management in a 5G network environment.
7. Explain best practices for securing network equipment to ensure stability, ease of maintenance, and future expansion.
8. Discuss common causes of thermal issues and how to prevent overheating in 5G network equipment.
9. Demonstrate how to assess the designated installation area for space availability, load-bearing capacity, and future expansion feasibility.
10. Show how to check facility entry points, door heights, and floor strength to ensure safe movement and installation of racks and equipment.
11. Demonstrate how to identify and select appropriate rack types based on equipment requirements and cable/device management.
12. Show how to ensure power supply circuits meet voltage, amperage, and redundancy needs for 5G network equipment operation.
13. Demonstrate how to verify the absence of heat sources in and around the installation area to prevent thermal risks.
14. Show how to assess the adequacy of active or passive cooling systems to manage heat dissipation.
15. Demonstrate how to develop a layout plan for rack placement, considering power distribution, ventilation, and future scalability.
16. Show how to confirm the availability of proper grounding and earthing systems to prevent electrical hazards.
17. Demonstrate how to arrange racks in a hot-aisle/cold-aisle configuration to improve cooling efficiency.
18. Show how to position and secure equipment inside racks while maintaining space for maintenance and future expansion.
19. Demonstrate how to inspect gNodeB and other 5G components for physical damage before installation.
20. Show how to report and coordinate with vendors for the replacement or repair of damaged or faulty 5G equipment.

21. Demonstrate how to mount and secure gNodeB and associated equipment using appropriate fasteners.
22. Show how to position heavier equipment at the lower sections of racks to maintain stability and prevent tipping hazards.
23. Demonstrate how to distribute high-density equipment across multiple racks to prevent thermal hotspots.
24. Show how to follow manufacturer guidelines and safety protocols while installing blade servers and PDUs.
25. Demonstrate how to connect power, network, and grounding cables following structured cabling best practices.

Resources to be Used

Presentation slides on different types of racks, dimensions, components, criteria for selecting a room, and installation process, Whiteboard or flipchart, Markers, Samples of different types of racks and equipment components, Room with racks and equipment (for demonstration purposes), Checklist for checking gNodeB damages and faults, Handouts with key points and guidelines

Say

- Hello everyone! Welcome to today's session on Preparing for the Installation of 5G Devices.
- You will learn about the different aspects of rack installation and ensure a smooth deployment of 5G infrastructure.
- By the end of this session, you will have a clear understanding of the various types of racks used, their dimensions, components, criteria for selecting a suitable room, the importance of managing heat sources, and the correct installation process. This knowledge will enable you to efficiently prepare for the installation of 5G devices.
- Understanding the intricacies of rack installation is crucial for a successful 5G deployment. A well-prepared installation process ensures proper functioning of the equipment, minimizes faults, and maximizes network performance. By mastering these concepts, you'll be equipped to contribute effectively to the installation process.

Do

- Familiarize the participants with the presentation slides and handouts.
- Set up the room or space for the session, ensuring that racks and equipment are available for demonstration purposes.
- Prepare the whiteboard or flipchart with the main topics to be covered during the session.
- Review the checklist for checking gNodeB damages and faults.
- Arrange the samples of different types of racks and equipment components in a visible and accessible manner.

Ask

- What do you understand by the term "rack" in the context of IT equipment installation?
- Why is it important to consider the dimensions of racks during the 5G installation process?
- Can you think of any potential sources of heat that should be avoided when selecting a room for rack installation?

Elaborate

Preparing for the Installation of 5G Devices:

- Explain different types of racks used for the installation of different types of it equipment
- Discuss the dimensions of racks that are required in the 5G installation process
- Explain the different components of racks
- Describe the criteria for selecting a room/space for the installation of racks
- Explain the importance of ensuring that there are no sources of heat in and around the room selected for the installation of racks and equipment
- Discuss the installation of equipment on racks
- Explain the process of checking gNodeB damages and faults
- Explain the placement of the racks in relation to the room and important resources

Demonstrate

Demonstrate the proper installation of equipment on racks using a sample rack and equipment components. Show how to secure the equipment and manage cable connections neatly.

Activity

1. **Name of the activity:** Rack Selection and Room Assessment
2. **Objective:** To apply the knowledge of rack types, dimensions, and room selection criteria to identify the most suitable rack and room setup for a hypothetical 5G installation project.
3. **Type of activity:** Group
4. **Resources:** Handouts, samples of racks and equipment components, room assessment checklist, markers.
5. **Time Duration:** 25 minutes
6. **Instructions:**
    - Divide participants into small groups.
    - Provide each group with a hypothetical scenario of a 5G installation project, including specific equipment requirements and room dimensions.
    - Instruct each group to select the appropriate rack type based on the equipment specifications and identify a suitable room based on the given dimensions and room assessment criteria.
    - Encourage group discussions and collaboration.
    - Ask each group to present their chosen rack and room setup, explaining their reasoning.
        - Facilitate a brief discussion to compare and contrast the different solutions.
        - Summarize the key points and highlight best practices for rack selection and room assessment.
7. **Outcome:** Participants will gain practical experience in selecting the right rack and assessing a room for 5G installation projects. They will understand the considerations involved in choosing the appropriate equipment setup.

Notes for Facilitation

- Ensure active participation and engagement throughout the session.
- Encourage questions, discussions, and sharing of experiences.
- Emphasize the importance of proper rack selection and room assessment for a successful 5G installation.

UNIT 2.2: Process of Carrying Out the Installation of 5G Devices

Unit Objectives

After the completion of this unit, participants will be able to:

1. Describe best practices for power and network cable management to ensure safety and maintain order.
2. Explain techniques for inspecting and identifying faults in gNodeB and other 5G hardware components.
3. Elucidate the safety procedures for installing high-power and high-density equipment.
4. Discuss industry best practices for structured cabling, grounding, and earthing in telecom environments.
5. Explain basic networking principles, including IP addressing, TCP/IP, and VLANs.
6. Describe common troubleshooting techniques for hardware faults, connectivity failures, and power issues.
7. Determine the steps required to configure virtualization environments for 5G network deployment.
8. Explain the importance of maintaining proper documentation for future maintenance and upgrades.
9. Demonstrate how to conduct a post-installation inspection to verify proper mounting, cabling, and power connectivity.
10. Show how to identify and correct common installation errors, such as loose connections or incorrect equipment placement.
11. Demonstrate how to perform initial power-on and basic operational tests for installed 5G network equipment.
12. Show how to troubleshoot hardware and connectivity issues following manufacturer guidelines.
13. Demonstrate how to escalate unresolved installation problems to relevant support teams.
14. Show how to configure operating system and virtual machine settings according to standard deployment procedures.
15. Demonstrate how to document installation details, including rack layout, power consumption, and network configurations.

Resources to be Used

Participant handbook, Presentation slides on the topics covered, Whiteboard or flipchart with markers, Handouts or reference materials on networking fundamentals, Sample 5G devices, racks, and IT equipment (optional), Troubleshooting guide for 5G equipment (optional)

Say

- Good morning/afternoon, everyone! Welcome to today's session on the process of carrying out the installation of 5G devices.
- At the end of this session, you will have a comprehensive understanding of the installation process for 5G devices, including planning rack placement, ensuring necessary resources, networking fundamentals, equipment dimensions, troubleshooting, and more.
- Understanding the installation process is crucial for ensuring the successful deployment of 5G networks.
- By grasping these concepts, you will be equipped to handle various challenges that may arise during the installation and configuration of 5G devices.

Do

- Introduce the topics covered in the session, providing an overview of each one.
- Present the content using visual aids, such as slides or diagrams, to enhance understanding.
- Encourage participants to ask questions and participate actively throughout the session.
- Provide real-life examples or case studies related to the installation process to illustrate concepts.
- Conduct demonstrations or practical exercises to reinforce learning.

Ask

- What is the importance of planning the placement of racks in relation to the room?
- Why is it essential to ensure correct voltages and sufficient amperage for 5G network equipment?
- How does active or passive ventilation help dissipate heat generated by 5G equipment?

Elaborate

Planning and Infrastructure Considerations for 5G Network Equipment Placement:

- Discuss the process of planning the placement of racks in relation to the room.
- Explain the importance of 5G resources, such as power circuits and cooling equipment.
- Cover networking fundamentals relevant to the installation of 5G devices.
- Discuss the standard dimensions of different types of IT equipment.
- Describe the criteria for selecting appropriate types of racks for safe placement of 5G network equipment.

Infrastructure and Maintenance Efficient 5G Network Installations:

- Explain the importance and process of ensuring the availability of correct voltages and sufficient amperage for all 5G network equipment.
- Discuss the importance of maintaining an absence of heat in and around the installation room.
- Explain the significance of active or passive ventilation for heat dissipation.
- Describe the process of arranging racks in a hot-aisle/cold-aisle layout to reduce energy use.
- Cover the process of troubleshooting any faults or malfunctions of 5G equipment.
- Explain the process of configuring the operating system with VMware.
- Discuss the importance of placing heavy equipment at the bottom of racks.

Demonstrate

Demonstrate the process of arranging racks in a hot-aisle/cold-aisle layout to reduce energy use. Show how airflow can be optimized and heat dissipation improved through proper rack placement.

Activity

1. **Name of the activity:** Rack Placement Simulation
2. **Objective:** To apply the knowledge of rack placement principles in a practical scenario (group activity)
3. **Resources:** Flipchart, markers, sample floor plan, cutouts of racks and equipment, tape
4. **Time Duration:** 30 minutes
5. **Instructions:**
   - Divide participants into small groups.
   - Provide each group with a sample floor plan and cutouts of racks and equipment.
   - Instruct the groups to plan the placement of racks in relation to the room, considering factors like airflow, heat dissipation, and equipment accessibility.
   - Encourage the groups to discuss and collaborate on their rack placement strategies.
   - Each group should present their proposed rack placement to the rest of the participants, explaining their reasoning and considerations.
   - Facilitate a brief discussion on the pros and cons of each group's approach and provide feedback.
   - Summarize the key takeaways from the activity, emphasizing the importance of thoughtful rack placement for optimal 5G device installation.
6. **Outcome:** Participants will gain hands-on experience in planning rack placement for 5G installations, applying the principles discussed during the session.

Notes for Facilitation

- Create a participatory and inclusive learning environment by actively engaging participants.
- Encourage open discussions and questions throughout the session to enhance understanding.
- Relate the content to real-world scenarios or examples to make it more relatable.
- Emphasize the importance of safety measures and adherence to installation standards.
- Provide additional resources or references for participants to explore further after the session.
- Remind participants of the significance of regular updates and staying up to date with the latest industry practices in 5G installation.

Exercise

Answers to exercises for PHB

A Short Answer Questions:

1. Ensures the rack can safely support equipment weight, fit device dimensions, and allow proper airflow and maintenance access.
2. They remove excess heat, maintain optimal operating temperature, and prevent equipment failure due to overheating.
3. They protect equipment and personnel from electrical faults, surges, and lightning by safely discharging excess current.
4. It ensures reliable connectivity, reduces interference, improves safety, and simplifies troubleshooting and maintenance.
5. It helps in troubleshooting, future upgrades, audits, and ensures continuity of maintenance activities.

B. Multiple Choice Questions:

1. b) Load-bearing capacity
2. c) Improve cooling efficiency
3. c) At the lower section of the rack
4. b) Earthing and grounding
5. b) Proper mounting, cabling, and power connectivity

C. Fill in the Blanks

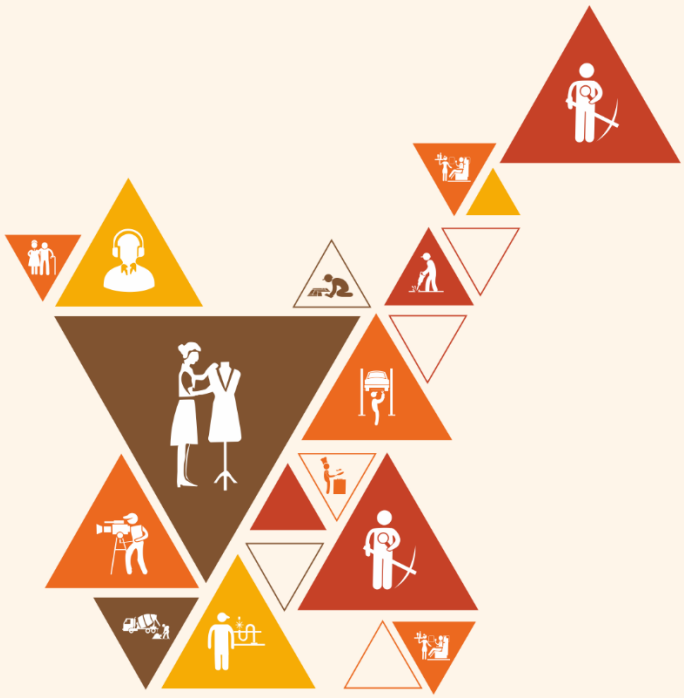
1. Power
2. Hotspots
3. Cable
4. Operational
5. Installation

Notes

3. Carry out 5G Active Network Installation

Unit 3.1 - Process of Carrying Out a Power, Earthing and RF Cabling

Unit 3.2 - Process of Installation and Commissioning Backhaul Connectivity



TEL/N6105

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Describe the process to carry out power, earthing, and RF cabling.
2. Explain how to install, configure, and commission backhaul connectivity.

UNIT 3.1: Process of Carrying Out a Power, Earthling and RF Cabling

Unit Objectives

After the completion of this unit, participants will be able to:

1. Explain industry standards, including 3rd Generation Partnership Project (3GPP) releases relevant to 5G network deployment.
2. Describe the components of 5G gNodeB, their functions, and interoperability requirements.
3. Explain power and grounding principles, including best practices for electrical safety and surge protection.
4. Discuss the types, specifications, and applications of power, earthing, and RF cables used in 5G installations.
5. Describe procedures for installing and securing power, earthing, and RF cables in compliance with industry regulations.
6. Explain best practices for routing and terminating cables between various types of antennas to minimize losses and interference.
7. Discuss tools and techniques for conducting cable transmission tests and identifying common faults.
8. Demonstrate how to ensure the availability of required installation materials, including terminal connectors, thimbles, surge protectors, and cable ties.
9. Show how to assess the power requirements of the gNodeB and associated equipment for compatibility with the available power supply.
10. Demonstrate how to select appropriate power, earthing, and RF cables based on specifications, load requirements, and environmental conditions.
11. Show how to inspect all cables for physical damage or manufacturing defects and coordinate replacements if necessary.
12. Demonstrate how to install and secure power cables from the power source to the equipment while complying with safety and regulatory standards.
13. Show how to establish proper earthing connections and measure earth resistance values within permissible limits.
14. Demonstrate how to install RF cables between the gNodeB, other radio equipment, and antennas to ensure minimal signal loss.
15. Show how to route and terminate cables correctly to omnidirectional and sector antennas while allowing flexibility for maintenance and upgrades.
16. Demonstrate how to conduct continuity and performance tests on installed cables using industry-standard tools and rectify issues if detected.
17. Show how to implement shielding and grounding techniques to mitigate electromagnetic interference (EMI) and ensure optimal signal transmission.

Resources to be Used

Participant handbook, presentation slides on the topics covered, whiteboard or flipchart with markers, sample power, earthing, and RF cables, equipment and tools for cable installation demonstration, reference materials on 3GPP releases and cable installation guidelines

Say

- Hello everyone! Welcome to today's session on the process of carrying out power, earthing, and RF cabling. I will guide you through the essential steps involved in ensuring reliable and efficient connections in a 5G network.
- At the end of this session, you will understand the importance of 3GPP releases, the use of different types of cables, the significance of proper routing and termination, and how to install power, earthing, and RF cables in a 5G network.
- This knowledge will empower you to contribute to the successful deployment of 5G infrastructure.
- A solid understanding of power, earthing, and RF cabling is crucial for establishing a robust and high-performing 5G network.
- It ensures stable power supply, effective grounding, and seamless transmission of signals, which are vital for network reliability and performance.

Do

- Start the session by engaging participants in a brief discussion on their understanding of 3GPP and its relevance to 5G networks.
- Present the content using visual aids, slides, or diagrams to facilitate understanding.
- Explain the importance of proper earthing and demonstrate the process of installing earthing cables to ensure a safe and reliable electrical ground.
- Discuss the use of different types of RF cables and their specific applications in 5G networks.
- Encourage questions and foster active participation throughout the session.

Ask

- What is the purpose of 3GPP releases in the context of 5G networks?
- Why is it important to ensure proper routing and termination of cables between omnidirectional and directional/sector antennas?
- How does proper earthing contribute to the safety and reliability of a 5G network?

Elaborate

- Explain the importance of the 3rd Generation Partnership Project (3GPP) and their releases relevant to the 5G network.
- Describe the use of different types of power, earthing, and RF cables in a 5G network.
- Explain the importance of ensuring appropriate routing and termination of cables between omnidirectional and directional or sector antennas for easy maintenance.
- Discuss the process of installing power cables between equipment and power sources to ensure reliable power supply.

Demonstrate

Demonstrate the process of installing power cables between equipment and power sources, showcasing the correct connections and safety precautions.

Activity

1. **Name of the activity:** Cable Routing and Termination Simulation
2. **Objective:** To apply the knowledge of cable routing and termination in a practical scenario (group activity)
3. **Type of Activity:** Group
4. **Resources:** Sample floor plan, cable cutouts, tape, markers
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Divide participants into small groups.
   - Provide each group with a sample floor plan and cable cutouts.
   - Instruct the groups to plan and route the cables between omnidirectional and directional/sector antennas, considering factors like maintenance, accessibility, and cable management.
   - Each group should present their proposed cable routing and termination plan, explaining their reasoning and considerations.
   - Facilitate a discussion among the groups to compare and evaluate the different approaches.
   - Summarize the key takeaways from the activity, emphasizing the importance of proper cable routing and termination for easy maintenance and network efficiency.
7. **Outcome:** Participants will gain hands-on experience in planning cable routing and termination, applying the principles discussed during the session.

Notes for Facilitation

- Relate the content to practical examples or real-life scenarios to enhance understanding.
- Emphasize the importance of following safety guidelines and industry standards when working with power, earthing, and RF cables.
- Encourage participants to ask questions and seek clarification throughout the session.
- Highlight the significance of regular updates and staying informed about the latest 3GPP releases and best practices in cable installation.

UNIT 3.2: Process of Installation and Commissioning Backhaul Connectivity

Unit Objectives

After the completion of this unit, participants will be able to:

1. Describe methods for establishing high-capacity Ethernet and fiber-based backhaul connectivity.
2. Explain backhaul network architecture, including CU-DU split, and its impact on network performance.
3. Discuss configuration and commissioning processes for gNodeB integration with the central unit.
4. Elucidate network synchronization techniques, including Precision Time Protocol (PTP) and Global Navigation Satellite System (GNSS) synchronization.
5. Explain security considerations for network elements, including data encryption, firewall settings, and access control.
6. Discuss methods for configuring and integrating environmental alarm systems for real-time network monitoring.
7. Describe the installation and optimization of OS and VM environments for supporting 5G network functions.
8. Explain testing methodologies to evaluate network performance, including latency, packet loss, and signal quality.
9. Demonstrate how to coordinate with relevant personnel to establish high-throughput Ethernet or fiber-optic backhaul connectivity.
10. Show how to deploy fiber optic solutions for backhaul connectivity using proper termination and splicing techniques.
11. Demonstrate how to validate and configure backhaul connectivity for seamless communication between gNodeB and the central office.
12. Show how to implement Centralised Unit–Distributed Unit (CU-DU) split architecture for optimized network functionality.
13. Demonstrate how to configure gNodeB settings to enable integration with the Centralised Unit (CU) and core network.
14. Show how to ensure gNodeB visibility in the central unit for remote commissioning, monitoring, and control.
15. Demonstrate how to install and integrate environmental alarm systems with the central monitoring unit for proactive site management.
16. Show how to deploy and configure the required Operating System (OS) and Virtual Machine (VM) environments for network operations.
17. Demonstrate how to verify network synchronization and timing configurations in line with industry standards for optimized performance.
18. Show how to conduct functional tests, including throughput and latency checks, to validate end-to-end connectivity and network performance.

Resources to be Used

Participant handbook, Presentation slides on the topics covered, Whiteboard or flipchart with markers, Sample gNodeB modules and equipment, Fiber optic cables and Ethernet cables, Tools for cable termination and connectivity demonstration, Reference materials on gNodeB architecture and backhaul connectivity guidelines

Say

- Welcome, everyone! Today, we're diving into the fascinating world of installing and commissioning backhaul connectivity for 5G networks.
- At the end of this session, you will understand the constituent modules of a 5G gNodeB, the process of determining power requirements, the significance of visibility between the gNodeB and central unit, and how to establish backhaul connectivity using Ethernet and fiber optic technologies.
- This knowledge will empower you to contribute to the successful installation and commissioning of backhaul connectivity in 5G networks.
- Understanding the process of installing and commissioning backhaul connectivity is crucial for creating a strong foundation for 5G networks.
- It ensures efficient data transfer, optimal performance, and seamless communication between network elements, ultimately enhancing the end-user experience.

Do

- Begin the session by engaging participants in a discussion about the constituent modules of a 5G gNodeB and their respective functions.
- Present the content using visual aids, slides, or diagrams to enhance understanding.
- Describe the process of determining power requirements for the gNodeB and other associated equipment, emphasizing the importance of accurate power provisioning.
- Explain the significance of making the gNodeB visible in the central unit and the benefits of having commissioning commands transmitted from the central unit.
- Demonstrate the process of establishing high-throughput Ethernet/fiber-based backhaul connectivity on the Ethernet interface, highlighting key steps and considerations.

Ask

- What are the main modules that make up a 5G gNodeB, and what are their functions?
- Why is it important to determine the power requirements of the gNodeB and other equipment accurately?
- How does making the gNodeB visible in the central unit facilitate commissioning commands and operations?

Elaborate

Installation and Configuration of 5G gNodeB Equipment:

- Explain the constituent modules of 5G gNodeB and their functions.
- Describe the process of determining the power requirements of the gNodeB and associated equipment.
- Explain the importance of making the gNodeB visible in the central unit to enable commissioning commands and seamless operations.
- Demonstrate the process of establishing high-throughput Ethernet/fiber-based backhaul connectivity on the Ethernet interface.
- Show how to use fiber optic cables for backhaul connectivity in a 5G network.
- Demonstrate how to terminate the backhaul connectivity to ensure proper configuration and connection to the central office.
- Explain the concept and process of creating a Centralized Unit-Distributed Unit (CU-DU) split base station.

Demonstrate

Demonstrate the process of terminating backhaul connectivity, showcasing proper cable termination techniques and ensuring the gNodeB is correctly connected to the central office.

Activity

1. **Name of the activity:** Power Requirements Calculation
2. **Objective:** To apply the knowledge of determining power requirements for gNodeB and associated equipment (individual activity)
3. **Type of Activity:** Individual
4. **Resources:** Sample gNodeB modules, power requirement guidelines, calculators
5. **Time Duration:** 25 minutes
6. **Instructions:**
    - Distribute sample gNodeB modules and provide participants with power requirement guidelines.
    - Ask participants to calculate the total power requirements for the given gNodeB configuration.
    - Participants can use calculators or other tools to perform the calculations.
    - After completing the calculations, ask participants to compare their results and discuss any discrepancies or challenges faced.
    - Facilitate a group discussion to review the correct approach and key considerations when determining power requirements for gNodeB.
7. **Outcome:** Participants will gain hands-on experience in calculating power requirements for gNodeB and understand the importance of accurate power provisioning.

Notes for Facilitation

- Encourage active participation and discussion throughout the session.
- Emphasize the importance of adhering to industry standards and best practices in backhaul connectivity installation.
- Highlight the significance of proper visibility and connectivity between gNodeB and the central unit for effective commissioning and operation.

Exercise

Answers to exercises for PHB

Multiple Choice Questions:

1. a. To develop and maintain the technical specifications of the network
2. c. Central unit, distributed unit, Ethernet interface, power supply
3. b. By calculating the power requirements of each component based on its specifications
4. a. To prevent interference between the different types of antennas
5. b. To allow the central unit to monitor and control the gNodeB

Descriptive Questions:

1. 3GPP develops and maintains global technical standards for 5G, ensuring interoperability, performance, and continuous evolution of the network.
2. The gNodeB modules handle radio transmission, signal processing, scheduling, mobility management, and connection to the 5G core network.
3. Power requirements are determined by calculating the total load of all equipment, considering peak power, redundancy, and safety margins.
4. Proper routing and termination ensure minimal signal loss, reduced interference, reliable connectivity, and better network performance.
5. To enable monitoring, control, fault management, and seamless integration with the core 5G network.

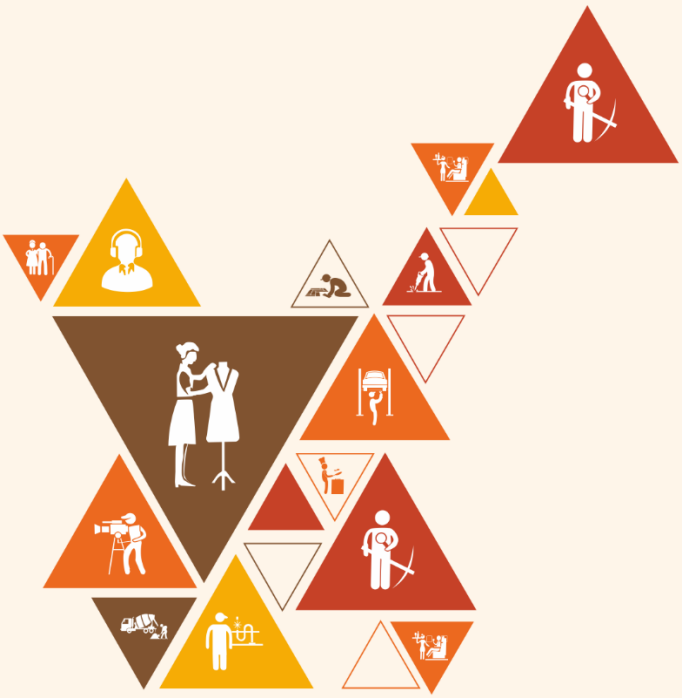
Notes

4. Follow the Occupational Health and Safety Instructions during Tower Climbing

Unit 4.1 - Pre-climbing Tower Inspection

Unit 4.2 - Process of Checking the Safety Equipment and Work Site Conditions

Unit 4.3 - Demonstrate the Process of Carrying out Tower Operations Following Safety Instructions



TEL/N6246

Key Learning Outcomes 

After the completion of this module, the participant will be able to:

1. Explain the procedures for conducting pre-climb safety inspections and identifying potential hazards at telecom worksites.
2. Describe the importance of PPE, environmental assessments, and compliance with safety regulations before climbing towers.
3. Explain the procedures for safe tower climbing, fall prevention, and the correct use of safety equipment.
4. Describe emergency preparedness strategies, including first aid, incident reporting, and hazard mitigation.

UNIT 4.1: Pre-climbing Tower Inspection

Unit Objectives

After the completion of this unit, participants will be able to:

1. Explain industry best practices for safe tower climbing and fall protection.
2. Describe the importance of well-maintained and certified safety equipment.
3. Elucidate the essential PPE requirements for tower climbing.
4. Discuss the procedures for conducting a visual inspection of the tower to detect loose hardware, rust, or structural damage.
5. Explain how to identify and mitigate climbing hazards such as bird nests, insect infestations, or external attachments.
6. Describe the process of inspecting turnbuckles and verifying proper tensioning of guy wires in guyed towers.
7. Enlist the steps to examine anchor points and supporting components for corrosion or mechanical damage.
8. Discuss the significance of verifying the vertical alignment of the tower using a plumb line or inclinometer.
9. Explain the importance of reporting identified defects and ensuring necessary repairs before climbing.
10. Describe the methods for conducting a Job Hazard Analysis (JHA) and developing an Emergency Action Plan (EAP).
11. Discuss electrical hazard mitigation strategies and safety regulations, including proximity to power lines.
12. Explain weather assessment techniques and decision-making for halting tower operations in extreme conditions.
13. Describe the procedures for reading and interpreting safety manuals and SOPs.
14. Elucidate the record-keeping process for safety inspections and maintenance logs. Demonstrate a visual inspection of the tower to detect structural defects before climbing.
15. Show how to identify and mitigate climbing hazards such as bird nests, insect infestations, or loose attachments.
16. Demonstrate the inspection of turnbuckles and verification of guy wire tensioning in guyed towers.
17. Show how to examine anchor points and supporting components for corrosion or mechanical damage.
18. Demonstrate the process of verifying vertical tower alignment using a plumb line or inclinometer.
19. Show how to inspect ladders, hoisting, and rigging equipment for operational readiness.
20. Demonstrate the proper pre-use inspection of PPE, including harnesses, lanyards, helmets, gloves, and boots.
21. Show how to measure RF exposure levels to ensure compliance with safety standards.
22. Demonstrate how to identify electrical hazards and implement mitigation strategies.
23. Show how to conduct a Job Hazard Analysis (JHA) and develop an Emergency Action Plan (EAP).
24. Demonstrate how to measure wind velocity and assess weather conditions for safe tower climbing.
25. Show how to position vehicles and equipment safely at the worksite.
26. Demonstrate the correct procedure for documenting safety inspections and maintenance logs.

Resources to be Used

Participant handbook, Presentation slides on the topics covered in the unit, Handouts or worksheets for note-taking, Binoculars for demonstration and practice, Two-way radios for demonstration and practice, Safety gear (e.g., harness, helmet, safety glasses), Visual aids (e.g., images or videos of tower inspections)

Say

- Welcome, everyone, to the session on Perform Pre-Climb Tower Inspection.
- Today, we will focus on the importance of getting adequate training and practice in tower climbing and inspecting the tower before climbing, using binoculars to check for loose or missing hardware.
- We will also understand the importance of using two-way radio for telecom riggers.

Ask

- Why is it important to receive proper training and practice in tower climbing?
- What potential risks or hazards can be identified during a tower inspection?

Elaborate

- Importance of Getting Adequate Training and Practice in Tower Climbing:
  - Discuss the potential risks and hazards associated with tower climbing.
  - Explain the need for proper training, certification, and ongoing practice to ensure safety.
  - Highlight the importance of following industry standards and best practices in tower climbing.
- Inspecting Tower before Climbing:
  - Learn about the key elements and components to inspect during a pre-climb tower inspection.
  - Understand the importance of visual inspections, identifying structural issues, and checking for potential hazards.
- Using Binoculars to Check for Loose or Missing Hardware:
  - Explain the role of binoculars in conducting a detailed visual inspection of the tower.
  - Demonstrate how to use binoculars effectively to identify loose or missing hardware, damaged components, or signs of deterioration.
- Importance of Using Two-Way Radio for Telecom Riggers:
  - Discuss the role of effective communication in tower climbing operations.
  - Highlight the benefits of using two-way radios for coordination, safety updates, and emergency situations.

Practical

- Perform a practical demonstration of a tower inspection using binoculars.
- Show the trainees how to scan the tower systematically, focusing on different areas and hardware connections.
- Emphasize the importance of attention to detail and thoroughness in the inspection process.

Activity

1. **Name of the activity:** Tower Inspection Practice
2. **Objective:** To provide hands-on experience in conducting a pre-climb tower inspection.
3. **Resources:** Safety gear, binoculars, visual aids
4. **Time Duration:** 45 minutes
5. **Instructions:**
    - Divide the trainees into small groups.
    - Provide each group with safety gear, binoculars, and visual aids representing different tower components.
    - Instruct the groups to conduct a simulated tower inspection, following the step-by-step process discussed in the session.
    - Encourage the groups to discuss their findings, share observations, and address any safety concerns they identify.
    - Rotate the groups and provide feedback and guidance as they perform the activity.
    - Conclude the activity by discussing the key findings, common challenges, and lessons learned from the inspection exercise.
1. **Outcome:** The trainees will have gained practical experience in conducting pre-climb tower inspections, improving their ability to identify potential hazards, and ensuring the safety of tower climbing operations.

Notes for Facilitation

- Emphasize the importance of safety throughout the session and during the activity. Reinforce the use of safety gear and adherence to safety protocols.
- Encourage active participation and engagement from all trainees during discussions and activities.
- Provide real-life examples and case studies related to tower inspection failures and their consequences to highlight the significance of thorough inspections.
- Ensure that trainees understand the importance of documenting and reporting any identified issues or safety concerns during tower inspections.
- Highlight the need for continuous learning and staying updated with industry standards and best practices in tower climbing and inspection procedures.

UNIT 4.2: Process of Checking the Safety Equipment and Work Site Conditions

Unit Objectives

After the completion of this unit, participants will be able to:

1. Explain industry safety protocols for tower climbing and fall protection.
2. Describe the process of registering at the worksite and adhering to safety protocols before climbing.
3. Elucidate the importance of securing a full-body harness and maintaining 100% tie-off at all times.
4. Discuss the correct use of a safety cable climb system or double lanyards while moving on the tower.
5. Explain how to properly use PPE following manufacturer guidelines.
6. Describe standard climbing procedures to prevent falls or slips.
7. Discuss the importance of maintaining continuous communication with the ground crew via a two-way radio.
8. Explain how to identify and report health issues that may impact climbing performance.
9. Elaborate on maintaining a safe distance from live power lines and coordinating de-energization.
10. Describe the procedures for placing warning signs near live electrical zones to prevent accidents.
11. Explain the key industry safety regulations (e.g., OSHA and local standards) relevant to telecom tower climbing.
12. Discuss the procedures for administering basic first aid in case of injuries or medical emergencies.
13. Describe the process of preparing incident reports for workplace hazards or accidents.
14. Explain decision-making strategies for emergencies, including extreme weather and equipment failure.
15. Discuss team collaboration techniques for maintaining a risk-free work environment.

Resources to be Used

Participant handbook, Presentation slides on the topics covered in the unit, Handouts or worksheets for note-taking, Safety equipment samples (e.g., harness, helmet, safety glasses, gloves), Tools, hoisting and rigging equipment samples, First aid kit and first aid training materials, RF safety regulations documentation, Electrical health and safety standards documentation, Visual aids (e.g., images or videos) related to safety equipment and work site conditions

Say

- Welcome, everyone, to the session on Safety Equipment and Work Site Conditions. Today, we will cover a range of topics focused on ensuring the safety of tower climbing and rigging work.
- We will discuss the importance of safety equipment, the dangers of performing rigging work without using personal protective equipment (PPE), inspections of tools and equipment, RF safety regulations, first aid and first aid kits, government regulations for telecom sites, electrical health and safety standards, and conducting comprehensive safety planning for job sites.

Ask

- Why is it important to use personal protective equipment (PPE) when performing rigging work?
- What are some potential hazards or risks associated with RF exposure in telecom sites?

Elaborate

- Safety Equipment for Tower Climbing:
  - Identify the essential safety equipment required for tower climbing (e.g., harness, helmet, safety glasses, gloves).
  - Explain the purpose and proper usage of each safety equipment item.
- Dangers of Performing Rigging Work without Using PPE:
  - Discuss the potential risks and hazards of not using personal protective equipment (PPE) during rigging work.
  - Highlight the importance of PPE in mitigating injuries and maintaining a safe work environment.
- Conducting Inspections of Tools, Hoisting and Rigging Equipment, and Other Machinery:
  - Learn about the importance of regular inspections to ensure the safety and proper functioning of tools, hoisting and rigging equipment, and other machinery used in telecom operations.
  - Explain the key elements and steps involved in conducting thorough inspections.
- RF Safety Regulations:
  - Provide an overview of RF (radio frequency) safety regulations and their significance in the telecom industry.
  - Discuss the potential health risks associated with RF exposure and the measures to mitigate them.
- First Aid and First Aid Box:
  - Explain the importance of first aid in emergency situations.
  - Discuss the contents and proper maintenance of a first aid box.
- First Aid for Different Types of Medical Emergencies:
  - Provide an overview of basic first aid procedures for common medical emergencies (e.g., bleeding, fractures, burns, cardiac arrest).
  - Discuss the importance of emergency preparedness and how to respond to medical situations.
- Government Regulations for Telecom Sites:
  - Explain the role of government regulations in ensuring safety and compliance at telecom sites.
  - Discuss key regulations and standards relevant to telecom operations.
- Electrical Health and Safety Standards:
  - Highlight the importance of electrical health and safety standards in telecom operations.
  - Discuss key safety measures and precautions related to electrical work.
- Conducting Comprehensive Safety Planning for Every Job Site:
  - Explain the process of conducting comprehensive safety planning for job sites, including hazard identification, risk assessment, and implementation of safety measures.

Demonstrate

- Perform practical demonstrations of safety equipment usage, tool and equipment inspections, and first aid procedures.
- Show the trainees how to properly wear safety equipment, conduct inspections, and administer basic first aid techniques. Emphasize the importance of following proper procedures and guidelines.

Activity

1. **Name of the activity:** Safety Equipment Inspection and Demonstration
2. **Objective:** To reinforce understanding of safety equipment usage and conducting inspections.
3. **Resources:** Safety equipment samples, tools and equipment samples, visual aids
4. **Time Duration:** 60 minutes
5. **Instructions:**
    - Divide the trainees into small groups.
    - Provide each group with safety equipment samples and tools and equipment samples.
    - Instruct the groups to conduct inspections of the safety equipment and tools, following the guidelines discussed in the session.
    - Encourage the groups to discuss their findings, share observations, and address any safety concerns they identify.
    - Rotate the groups and provide feedback and guidance as they perform the activity.
    - Conclude the activity by discussing the key findings, common challenges, and best practices related to safety equipment inspections.
1. **Outcome:** The trainees will have gained practical experience in inspecting safety equipment and tools, reinforcing their understanding of safety requirements in telecom operations.

Notes for Facilitation

- Emphasize the importance of safety throughout the session and during the activity. Reinforce the use of safety equipment and adherence to safety protocols.
- Encourage active participation and engagement from all trainees during discussions and activities.
- Provide real-life examples and case studies related to safety incidents in tower climbing and rigging work to highlight the consequences of neglecting safety measures.
- Facilitate group discussions to encourage knowledge sharing and the exchange of best practices among trainees.
- Highlight the significance of ongoing training and staying updated with industry standards and regulations related to safety equipment and work site conditions.

UNIT 4.3: Demonstrate the Process of Carrying out Tower Operations Following Safety Instructions

Unit Objectives

After the completion of this unit, participants will be able to:

1. Demonstrate the registration process and adherence to safety protocols before climbing.
2. Show how to properly secure a full-body harness and maintain 100% tie-off at all times.
3. Demonstrate the correct use of a safety cable climb system or double lanyards while moving on the tower.
4. Show how to inspect, wear, and adjust PPE according to manufacturer guidelines.
5. Demonstrate standard climbing techniques to prevent falls or slips.
6. Show how to use a two-way radio to maintain continuous communication with the ground crew.
7. Demonstrate how to report health issues that may impact climbing performance.
8. Show how to identify and maintain a safe distance from live power lines or coordinate de-energization.
9. Demonstrate the proper placement of warning signs near live electrical zones.
10. Show how to administer basic first aid for common tower climbing injuries.
11. Demonstrate the process of documenting and reporting unsafe conditions and workplace hazards.
12. Show how to prepare an incident report following an accident or emergency.

Resources to be Used

Participant handbook, whiteboard, markers, laptop, projector, full-body harness, helmet, gloves, safety shoes, double lanyards, safety cable climb system, two-way radios, warning signs, first-aid kit, sample incident report format.

Say

- Good Morning everyone!
- Today's session is one of the most critical sessions of your entire training. Tower climbing is a high-risk activity, and following the right safety practices can literally save lives—yours and your teammates'. By the end of this unit, you will know exactly how to climb safely, communicate clearly, and respond to emergencies responsibly.

Ask

Ask the participants:

- What do you think is the biggest risk while working on a telecom tower?
- Have you ever seen or heard about a tower climbing accident? What went wrong?

Write their answers on the whiteboard.

Link their responses to the importance of proper PPE, tie-off systems, and communication.

Elaborate

In this session, we will cover:

- Pre-climb registration and medical fitness checks
- Full-body harness fitting and 100% tie-off rule
- Use of double lanyards and safety cable systems
- Inspection and correct wearing of PPE
- Safe climbing techniques and body posture
- Two-way radio communication with ground staff
- Reporting health issues before climbing
- Electrical safety and distance from live power lines
- Placement of warning signs near danger zones
- First-aid for falls, cuts, shocks, and exhaustion
- Hazard reporting and unsafe condition documentation
- Accident reporting and emergency response procedures

Say

Let us now participate in an activity “Harness & Tie-Off Demonstration” to understand tower safety in a practical way.

Activity

1. **Name of the activity:** Harness & Tie-Off Demonstration
2. **Resources:** Full-body harness, helmet, lanyards, safety cable system.
3. **Time Duration:** 30 minutes
4. **Instructions:**
    - Demonstrate the correct method of wearing a full-body harness.
    - Show how to check buckles, straps, D-rings, and anchor points.
    - Explain the concept of 100% tie-off.
    - Allow each trainee to practice:
        - Wearing the harness
        - Connecting double lanyards
        - Simulating safe movement while remaining tied off
    - Correct posture and mistakes in real-time.

Notes for Facilitation

- Encourage trainees to openly share fear, doubts, or past experiences.
- Never rush PPE or safety demonstrations.
- Reinforce that no job is more important than personal safety.Ask trainees to revise tower safety rules from their participant manual.

Exercise

Answers to exercises for PHB

Multiple Choice Question

1. a. It minimizes the chances of accidents and injuries during tower climbing.
2. b. To ensure that the tower is safe for climbing.
3. c. To reduce the risk of accidents and injuries.
4. a. To maintain communication with the ground crew.
5. a. To reduce the risk of accidents and injuries.

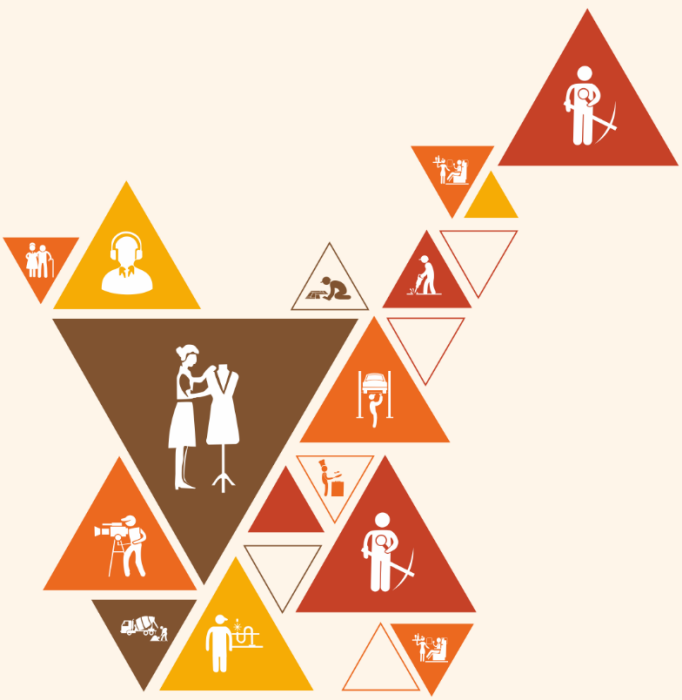
Descriptive Questions:

1. Refer: UNIT 4.1: Perform Pre-Climb Tower Inspection
   Topic - 4.1.2 Inspecting Tower before Climbing
2. Refer: UNIT 4.2: Safety Equipment and Work Site Conditions
   Topic - 4.2.3 RF Safety Regulations
3. Refer: UNIT 4.2: Safety Equipment and Work Site Conditions
   Topic - 4.2.2 Conducting Inspections of Tools, Hoisting and Rigging Equipment, and Other Machinery
4. Refer: UNIT 4.2: Safety Equipment and Work Site Conditions
   Topic - 4.2.6 Electrical Health and Safety Standards
5. Refer: UNIT 4.2: Safety Equipment and Work Site Conditions
   Topic - 4.2.4 First Aid

Notes

5. Follow Sustainable Practices in Telecom Infrastructure Installation

Unit 5.1- Environmental Sustainability and Waste Management in the Telecommunications Industry



TEL/N9105

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Determine the methods used to diagnose and rectify wiring faults in wireless networks.
2. Explain the process of troubleshooting and repairing Wi-Fi backhaul equipment operating at 5 GHz.
3. Describe the procedures for troubleshooting and restoring Wi-Fi access points operating at 2.4 GHz.
4. Discuss the steps involved in carrying out documentation and restoring the worksite after wireless network fault rectification.

UNIT 5.1: Environmental Sustainability and Waste Management in the Telecommunications Industry

Unit Objectives

After the completion of this unit, participants will be able to:

1. Explain national and international environmental laws and regulations governing telecom infrastructure installation.
2. Describe e-waste management and recycling policies applicable to telecom sites.
3. Identify occupational safety and health standards related to environmental practices.
4. List recyclable and refurbishable telecom components and their proper handling techniques.
5. Define methods for reducing electronic waste through responsible procurement and reuse.
6. Explain advancements in eco-friendly telecom infrastructure and the use of renewable energy sources.
7. Elucidate techniques for optimizing energy consumption in telecom operations.
8. Describe proper disposal methods for hazardous and non-hazardous waste.
9. Explain procedures for collaborating with authorized agencies for waste collection and disposal.
10. Identify best practices for reducing the carbon footprint of telecom installations.
11. Show how to identify telecom components suitable for recycling or refurbishment.
12. Demonstrate the process of sorting electronic and non-electronic waste according to disposal protocols.
13. Show the correct labeling and storage of recyclable and refurbishable components.
14. Demonstrate the safe handling and disposal of hazardous and non-hazardous waste.
15. Show the proper coordination process with authorized e-waste recycling units or disposal agencies.
16. Demonstrate the use of energy-efficient tools and equipment during telecom installations.
17. Show how to optimize infrastructure placement to minimize energy consumption.
18. Demonstrate the maintenance of records for waste disposal and sustainability measures.
19. Show how to guide team members on sustainable practices and encourage environmentally responsible habits.

Resources to be Used

Participant handbook, pen, pencil, notepad, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, sample e-waste bins, labels, PPE (gloves, masks), and demonstration components.

Notes For Facilitation

In this unit, we will discuss environmental sustainability practices and waste management procedures followed in the telecom sector.

Say

Good Morning everyone, and welcome back!
In this session, we will explore how the telecom industry is adopting sustainable practices and managing waste responsibly. As future broadband technicians, your role in keeping our environment clean and safe is extremely important.

Ask

Ask the participants the following questions:

- Why do you think sustainability is important in the telecom sector?
- Have you ever seen or handled e-waste before?

What challenges did you notice?Write down the trainees' answers on the whiteboard or flipchart.
Use their responses as a starting point to explain today's lesson.

Elaborate

In this session, we will discuss the following points:

- Environmental Sustainability in Telecom Industry
- Environmental Laws and Regulations in Telecommunications.
- E-Waste in the Telecom Industry
- E-Waste Management Process in the Telecom Industry
- Occupational Safety in Environmental Practices for Telecom E-Waste Management
- Energy Optimization in Telecom Operations
- Reducing the Carbon Footprint in Telecom
- Documentation and Compliance Tracking in Telecom Environmental Management

Say

Let us now participate in an activity to explore these topics more deeply.

Activity

Duration: 30 minutes

Resources: Sample components (cables, adapters, packaging materials), e-waste bins, labels, gloves, markers, projector, laptop, whiteboard.

Steps:

1. Divide the class into small groups.
2. Give each group a mix of telecom-related items (e.g., cable scraps, old router parts, batteries, plastic packaging).
3. Ask them to sort the items into:
    - Recyclable
    - Refurbishable
    - Hazardous waste
    - General waste
4. Display a checklist on the projector for guidance.
5. After all groups finish, reveal the correct sorting categories and explain the reasoning behind each decision.

Do

- Ask a student to maintain scores or observations on the whiteboard.
- Write down important points shared by trainees.
- Add your own insights based on industry best practices.
- Encourage every student to engage in discussions and participate in sorting activities.
- Ask one participant to summarize the key learnings of the session.
- Maintain positive energy and show enthusiasm for sustainability practices.

Activity

Duration: 25 minutes

Resources: Laptop, projector, sample telecom equipment (router/ONT), power meter (if available), pictures/videos of solar-powered telecom sites, whiteboard, markers.

Steps:

1. Divide the class into small groups.
2. Play a short video or show images demonstrating energy-efficient telecom practices such as:
3. Use of solar panels
    - Smart cooling techniques
    - Low-power CPE devices
    - Optimized equipment placement to reduce heat load

Provide each group with a scenario—for example:“A broadband installation site has high energy consumption due to poor equipment placement. Suggest three improvements.”

4. Ask the groups to discuss and write down their solutions.
5. Invite one member from each group to present their recommendations.
6. Summarize the key practical techniques used in the industry to save energy.

Do

- Ask a trainee to note down the key energy-saving suggestions shared by each group on the whiteboard.
- Highlight the practical feasibility of each idea and relate them to real telecom installation scenarios.
- Add your own insights—especially where small changes (like repositioning equipment or using smart adapters) can lead to big energy savings.
- Encourage quieter students to share their thoughts or add to the discussion.
- Ask one participant to briefly recap the energy-efficiency techniques discussed in the activity.
- Reinforce the importance of using energy-efficient tools and practicing mindful consumption during field installations.

Notes for Facilitation

- Ask trainees if they have any questions or doubts regarding waste handling or environmental laws.
- Encourage peer learning by inviting other trainees to answer queries.
- Remind participants to read the related section in their participant manual.
- Reinforce the importance of safe handling, labeling, and correct segregation while working on telecom sites.

Exercise

Answers to exercises for PHB

Multiple-Choice Questions (MCQs)

b) To avoid damage to the cable corec) Duct laying method
b) Cable winch machine
b) To avoid excessive friction and damage
b) Using approved cable ties or clamps

Descriptive Questions

1. Step-by-step procedure for direct burial cable laying

- Conduct a site survey and mark the cable route.
- Excavate the trench to the required depth.
- Lay a layer of sand or soft soil at the base.
- Place the cable carefully without exceeding bend radius.
- Cover the cable with sand and protective tiles/warning tape.
- Backfill the trench and compact the soil.
- Test cable continuity and performance after installation.

2. Safety precautions during underground cable laying

- Ensure all underground utilities (water, gas, electricity) are identified before digging.
- Use PPE: gloves, safety shoes, helmets, eye protection.
- Maintain safe distance from live electrical cables.
- Use proper tools for excavation and lifting.
- Avoid working in wet or unstable soil conditions.
- Ensure trench shoring to prevent collapse.

3. Difference between aerial and underground cable laying

- Cost: Aerial is cheaper; underground is more expensive due to excavation and protection materials.
- Durability: Underground cables are safer from weather and vandalism; aerial cables are more exposed.
- Maintenance: Aerial cables are easy to access and repair; underground maintenance is difficult, costly, and time-consuming.

4. Role and importance of cable jointing and termination

- Ensures continuity and reliable signal/power transfer.
- Provides mechanical and environmental protection at connection points.
- Reduces losses, electrical faults, and downtime.
- Maintains safety by insulating and securing conductors properly.

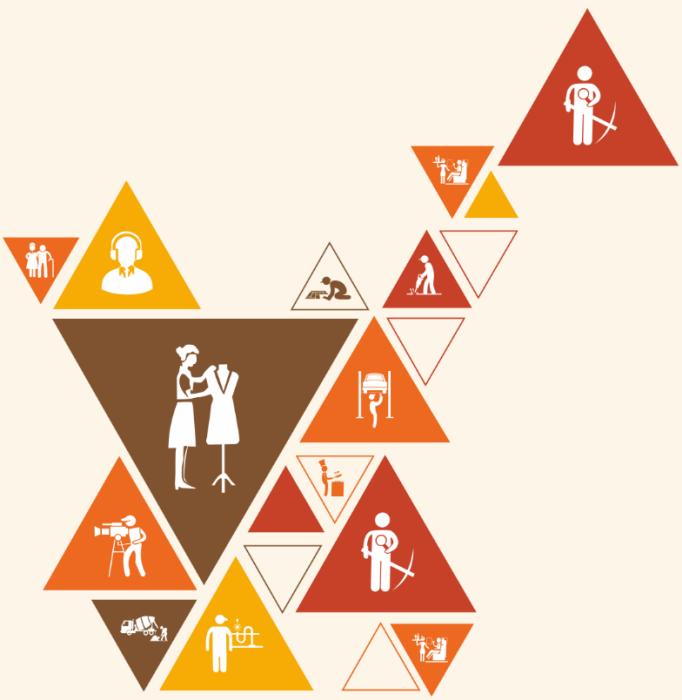
5. Common challenges in urban cable laying & solutions

- Limited space: Use micro-trenching and duct methods.
- Traffic congestion: Work during off-peak hours and use proper barricading.
- Utility congestion: Conduct detailed utility mapping and use cable locators.
- Permission and coordination issues: Work closely with local authorities and utility providers.
- Obstructions like buildings, pipelines: Use directional drilling or rerouting techniques.

Notes

6. Employability Skills (60 Hours)

It is recommended that all training include the appropriate. Employability Skills Module. Content for the same can be accessed https://www.skillindiadigital.gov.in/content/list



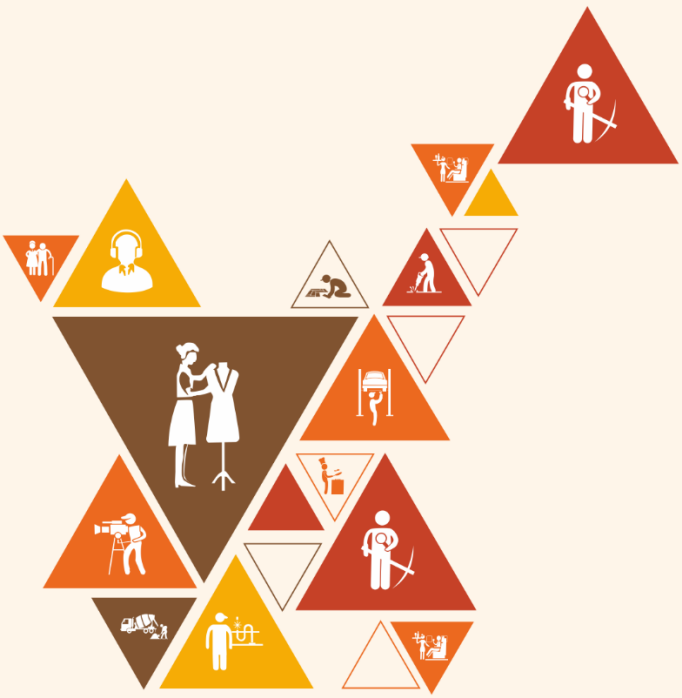
DGT/VSQ/N0102

7. Annexure

Annexure I: Training Delivery Plan

Annexure II: Assessment Criteria

Annexure III: List of QR Codes used in PHB



Annexure I
Training Delivery Plan

Training Delivery Plan			
Program Name:	Technician 5G – Active Network Installation		
Qualification Pack Name & Ref. ID	Technician 5G – Active Network Installation, TEL/Q6213 V3.0		
Version No.	3.0	**Version Update Date**	08-05-2025
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	**By the end of this program, the participants will be able to:** 1. Demonstrate the process of installing the relevant 5G network infrastructure. 2. Demonstrate the process of maintaining the 5G network infrastructure. 3. Describe the process of following the occupational health and safety instructions during tower climbing. 4. Explain the importance of implementing effective communication and coordination at work. 5. Explain the importance of managing work and resources, and ensuring health and safety at work.		

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	Introduction to the role of a 5G Technician – Active Network Installation (Theory- 05:00 Hours Practical- 00:00 Hours)	Introduction to the Telecom In-dustry	• Describe the size and scope of the Telecom industry and its sub-sectors.	Bridge module	Classroom lecture / Power-Point Presentation / Group Discussion / Quiz	Training Kit - Trainer Guide, Presentations, White-board, Marker, Projector, Laptop, Video Films	T- 01:00 P- 00:00
		Role and Re-sponsibilities of a 5G Technician	• Discuss the role and responsibilities of a 5G Technician – Active Network Installation. • Identify various employment opportunities for a 5G Technician – Active Network Installation.				T- 02:00 P- 00:00
		Organizational Policies and Workflow	• Discuss the organizational policies on workplace ethics, managing sites, quality standards, person-nel management, and public relations (PR).				T- 01:00 P- 00:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Describe the process workflow in the organization and the role of a 5G Technician – Active Network Installation in the process.				
		Daily Operations and Technical Skills	• List the various daily, weekly, monthly operations/activities that take place at the site under a 5G Technician – Active Network Installation. • Demonstrate Software testing and configuration, as well as hardware and peripheral device maintenance and repair. • Evaluate network performance and find ways of improvement.				T- 01:00 P- 00:00
2	Carry out Rack Level Installation (Theory- 45:00 Hours Practical- 60:00 Hours)	Assessing Rack Space and Equipment Compatibility	• Check room space availability for rack installation. • Check availability of appropriate racks for 5G equipment. • Identify different types of racks for IT equipment. • Explain standard rack dimensions.	TEL/N6104 PC1, PC3, KU1, KU2	Classroom lecture / PowerPoint Presentation / Group Discussion / Quiz	Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop, Fiber Cable Port, POE Switch, Optical Fiber Cable, Transceiver, Patch Panel	T- 03:00 P- 05:00
		Equipment and Room Evaluation	• Ensure proper electrical support for 5G equipment. • Verify the absence of heat sources near the installation area.	TEL/N6104 PC4, PC5			T- 03:00 P- 05:00
			• Check facility doors and floor suitability for equipment movement. • Define criteria for selecting an installation room.	TEL/N6104 PC2, KU5			T- 03:00 P- 05:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Ventilation and Heat Manage-ment	• Ensure adequate ventilation for heat dissipation. • Explain the importance of ventilation for equipment. • Recognize the significance of heat source prevention.	TEL/N6104 PC6, KU9, KU10			T- 03:00 P- 05:00
		Planning and Coor-dination	• Develop a plan for rack placement in relation to resources. • Coordinate with personnel or manufacturers for repairs. • Learn the process of planning rack placement. • Define criteria for selecting appropriate racks.	TEL/N6104 PC7, PC11, KU7, KU11			T- 04:00 P- 04:00
		Energy Efficiency and Rack Layout	• Arrange racks in hot-aisle/cold-aisle layout. • Explain the process of optimizing rack layout for energy efficiency.	TEL/N6104 PC12, KU12			T- 03:00 P- 04:00
		Equipment Installa-tion and Safety	• Follow manufacturer instructions for equipment installation. • Explain the process of setting up equipment safely.	TEL/N6104 PC15, KU15			T- 03:00 P- 04:00
		Trouble-shooting and Fault Resolution	• Identify and troubleshoot equipment faults as per manufacturer instructions. • Recognize common 5G equipment faults and troubleshooting.	TEL/N6104 PC16, KU18			T- 04:00 P- 04:00
		Configu-ration and Network-ing Funda-mentals	• Learn the process of configuring the operating system with VMWare. • Explain networking fundamentals like TCP/IP, DNS, SSH, SSL, HTTP.	TEL/N6104 KU19, KU20			T- 03:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Rack Component Knowledge	• Identify different components of racks. • Explain the standard dimensions of IT equipment.	TEL/N6104 KU3, KU4			T- 03:00 P- 04:00
		Load Management in Racks	• Learn the process of planning equipment placement in racks. • Ensure heavy equipment is placed at the bottom of racks. • Recognize the importance of proper load distribution in racks.	TEL/N6104 PC13, KU13, KU16			T- 04:00 P- 04:00
		Vendor Equipment Inspection	• Check vendor-provided equipment for damage. • Coordinate with manufacturers to resolve manufacturing faults.	TEL/N6104 PC10, PC17			T- 03:00 P- 04:00
		Rack Types and Equipment Compatibility	• Explain different types of racks for 5G equipment. • Recognize the importance of electrical support for 5G equipment.	TEL/N6104 KU6, KU8			T- 03:00 P- 04:00
		Maximizing Space Utilization	• Plan equipment installation for space optimization. • Carry out installation of high-density equipment to prevent hot spots.	TEL/N6104 PC9, KU14			T- 03:00 P- 04:00
3	Carry out 5G active network installation (Theory- 70:00 Hours Practical- 70:00 Hours)	Installation Materials and Power Requirements	• Ensure availability of required installation materials. • Discuss about different types of power, earthing, and RF cables.	TEL/N6105 PC1, KU4	Classroom lecture / PowerPoint Presentation / Group Discussion / Quiz	Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop, Earthing Cable, Signal Analysis Software,	T- 04:00 P- 04:00
			• Determine the power requirements of gNodeB and equipment. • Explain the process of determining power requirements.	TEL/N6105 PC2, KU3			T- 04:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Cable Availability and Inspection	• Check availability of appropriate power, earthing, and RF cables. • Inspect and coordinate cable replacement if faulty. • Recognize the importance of cable types and quality.	TEL/N6105 PC3, PC4, KU4		5G Multiband Transceiver, Centralised Unit–Distributed Unit (CU-DU), RF Cable, Fibre Optic Cable, RF Connectors, 5G Radio Unit	T- 04:00 P- 04:00
		Power and Earthing Cable Installation	• Install power cables for equipment. • Install earthing cables within specified limits. • Learn the process of installing power and earthing cables.	TEL/N6105 PC5, PC6, KU5			T- 04:00 P- 04:00
		RF Cable Installation and Maintenance	• Install RF cables between equipment and antennas. • Ensure appropriate routing for easy maintenance. • Check transmission and troubleshoot common faults. • Explain the process of RF cable installation and maintenance. • Learn troubleshooting procedures for RF cables.	TEL/N6105 PC7,PC8,PC98, KU5, KU7			T- 04:00 P- 04:00
		Backhaul Connectivity	• Coordinate and establish high throughput Ethernet/ fiber-based backhaul connectivity. • Use fiber optic for backhaul connectivity. • Terminate backhaul connectivity for gNodeB configuration. • Explain the process of establishing backhaul connectivity. • Learn about the importance of backhaul termination.	TEL/N6105 PC10, PC11, PC12, KU8, KU9			T- 04:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Centralized Unit-Distributed Unit Architecture	• Create Centralized Unit-Distributed Unit (CU-DU) split architecture. • Learn the process of creating CU-DU architecture.	TEL/N6105 PC13, KU10			T- 04:00 P- 04:00
		Configuring gNodeB	• Configure gNodeB to the Centralized Unit (CU). • Follow recommended measures to make gNodeB visible in the central unit.	TEL/N6105 PC14, PC15, KU11			T- 04:00 P- 04:00
			• Explain the process of configuring gNodeB.				T- 03:00 P- 03:00
		Environmental Alarm Systems	• Install environmental alarm systems and configure them to the central unit.	TEL/N6105 PC16, KU13			T- 04:00 P- 04:00
			• Learn the process of installing and configuring environmental alarm systems.				T- 03:00 P- 03:00
		Operating System and VMWare	Install the appropriate Operating System (OS) and Virtual Machine (VM) ware.	TEL/N6105 PC17, KU14			T- 04:00 P- 04:00
			Learn the process of installing Operating System and VMWare.				T- 04:00 P- 04:00
		Explaining 3GPP and Releases	• Elaborate 3rd Generation Partnership Project (3GPP) and their releases relevant to the 5G network.	TEL/N6105 KU1			T- 04:00 P- 04:00
		gNodeB Modules and Functions	• Discuss about the constituent modules of 5G gNodeB and their functions.	TEL/N6105 KU2			T- 04:00 P- 04:00
		Cable Routing and Maintenance	• Recognize the importance of appropri-ate cable routing for easy maintenance.	TEL/N6105 KU6			T- 04:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Centralized Unit Visibility	• Explain the importance of making gNodeB visible in the central unit for commissioning commands.	TEL/N6105 KU12			T- 04:00 P- 04:00
		Monitoring Network Operations	• Demonstrate the process of monitoring the site in the network operation center.	TEL/N6105 KU13			T- 04:00 P- 04:00
4	Follow the Occupational Health and Safety Instructions during Tower Climbing (Theory- 20:00 Hours Practical- 30:00 Hours)	Tower Inspection and Hazard Identification	• Perform visual observation of the tower for loose or missing hardware. • Identify climbing obstructions and hazards. • Explain the importance of adequate training in tower climbing. • Learn the process of administering first aid for different medical emergencies. • Recognize the importance of identifying and reporting unsafe conditions.	TEL/N6246 PC1, PC2, KIU1, KU6, KU7	Classroom lecture / PowerPoint Presentation / Group Discussion / Quiz	Training Kit (Trainer Guide, Presentations), Whiteboard, Marker, Projector, Laptop, PPE Kit, Safety Kit, Carabiners Connectors, Harnesses, RF Safety, Two Way Radios, Tower Climbing Kits, Helmet, RF Monitor	T- 02:00 P- 06:00
		Safety Equipment and PPE	• Check availability of safety equipment and tools. • Inspect and use appropriate Personal Protective Equipment (PPE). • Explain the importance of well-maintained safety equipment. • Identify the appropriate PPE required for tower climbing.	TEL/N6246 PC7, PC8, KU2, KU3 PC9, PC28, KU4, KU18			T- 03:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Ensure a fully-equipped first aid kit is available. • Assist in preparing incident reports. • Recognize the importance of first aid kits. • Learn the importance and process of preparing incident reports.				
		Safety Plan-ning and Weather Awareness	• Coordinate comprehensive safety planning. • Check weather conditions before working at heights. • Explain the importance of safety planning. • Recognize the significance of checking weather conditions. • Check for electrical hazards. • Work safely near electricity wires. • Place appropriate warning signs near live electricity wires. • Learn about applicable electrical health and safety standards.	TEL/N6246 PC12, PC14, KU10, KU11 PC11, PC24, PC25, KU15			T- 03:00 P- 04:00
		Equip-ment and Machinery In-spection	• Ensure safe distance from potential danger near tower sites. • Identify unsafe conditions and report promptly. • Recognize the process of conducting inspections of equipment and machinery. • Explain applicable health and safety standards and regulations.	TEL/N6246 PC16, PC13, KU14, KU17			T- 03:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Climbing Techniques and Practices	• Use a full-body harness and maintain complete tie-off. • Use safety cable climb or multiple lanyards when moving on towers. • Use appropriate PPE while climbing and working on towers. • Follow recommended tower climbing practices. • Learn the appropriate climbing and working practices for telecom structures.	TEL/N6246 PC18, PC19, PC20, PC21, KU16			T- 03:00 P- 04:00
		Communication and Health	• Use a two-way radio for communication. • Report impaired physical health affecting work at heights. • Explain the benefit of using two-way radios for communication. • Learn the importance of not working at heights in case of impaired physical health.	TEL/N6246 PC22, PC23, KU5, KU12			T- 03:00 P- 04:00
		RF Safety and Compliance & Continuous Learning and Safety Awareness	• Check the strength of radio waves with an RF detector. • Discuss about RF safety and regulatory compliance. • Recognize the importance of regular safety training and checking PPE. • Explain the importance of continually enhancing safety skills and awareness.	TEL/N6246 PC10, KU9 KU8, KU13			T- 03:00 P- 04:00

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
5	Follow sustainable practices in telecom infrastructure installation (Theory-10:00 Practical-20:00)	Segregate recyclable and refurbishable components	• identify telecom components suitable for recycling or refurbishment • .Explain how to sort electronic and non-electronic waste based on disposal protocols • .Show how to label and store recyclable and refurbishable components separately	TEL/N9105 PC1, PC2, PC3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Types of cables (OFC, UTP, STP, Twisted Pair etc.) and connectors (RJ-45, RJ-11 etc.), crimping tools, soldering tools and splicing tools, signal level meters /OTDR, voltmeter, digital multimeter, digital clamp meter, signal tester, electrical drill, ladder, spanner, screwdriver set, nut driver set, bolt remover, cutter, angle finder, Wiring layout, Instruction manual, Service Manual/ User Manuals, Customer Registration, Program Authentication Form, CustomerFeed back form	T: 02:30 P: 05:00
		Dispose of waste & Use Energy-Efficient Methods	•Explain how to follow approved procedures for the safe disposal of hazardous and non-hazardous waste • Discuss how to coordinate with authorized e-waste recycling units or certified disposal agencies •Show how to select and use energy-efficient tools and equipment during telecom installations	TEL/N9105 PC4, PC5, PC7			T: 02:30 P: 05:00
		Follow environmental standards and compliance guidelines	• .Discuss how to adhere to national and international environmental regulations for telecom infrastructure installation • Explain how to maintain records of waste disposal, recycling, and sustainability measures	TEL/N9105 PC10, PC11, PC12, PC13			T: 02:30 P: 05:00
		Guide team members	• Explain how to guide team members on sustainable telecom installation guidelines and practices • .Discuss how to encourage environmentally responsible work habits	TEL/N9105 PC14, PC15			T: 02:30 P: 05:00

Annexure II
Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Technician 5G – Active Network Installation	
Job Role	Technician 5G – Active Network Installation
Qualification Pack	TEL/Q6213, V3.0
Sector Skill Council	Telecom Sector Skill Council

S. No.	Guidelines for Assessment
1	The assessment for the theory part will be based on knowledge bank of questions approved by the SSC.
2	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/ option NOS/ Set of NOS.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.
5	To pass the Qualifications File, every trainee should score a minimum of 70% of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

National Occupational Standards	NOS Code & Version	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
Carry out Rack Level Installation	TEL/N6104, v2.0	30	50	-	20	100	25
Carry out 5G active network installation	TEL/N6105, v2.0	30	50	-	20	100	25
Follow the Occupational Health and Safety Instructions during Tower Climbing	TEL/N6246, v2.0	30	50	-	20	100	20
Follow sustainable practices in telecom infrastructure installation	TEL/N9105, v1.0	30	50	-	20	100	20
Employability Skills (30 Hours)	DGT/VSQ/N 0101, v1.0	20	30	-	-	50	10
Total		**140**	**230**	**-**	**80**	**450**	**100**

Annexure-III

QR Codes –Video Links

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
1. Introduction to the Role of a 5G Technician – Active Network Installation	UNIT 1.1: Job Role of a 5G Technician	1.1.1 Size of Telecom Industry and Its Sub Sectors	https://www.youtube.com/watch?v=T2SaEuF6i1M	Evolution of Telecom Industry in India
		1.1.5 Responsibilities and challenges of a 5G Technician	https://www.youtube.com/watch?v=gQr08TnPFno	What are the challenges of building out a 5G network?
2. Process of Carrying Out Rack-level Installation	UNIT 2.1: Preparing for the Installation of 5G Devices	2.1.1 Different Types of Racks Used for the Installation of Different Types of IT Equipment	https://www.youtube.com/watch?v=DpJmI0KrzVM	Networking Equipment Racks
		2.1.3 Different Components of Racks	https://www.youtube.com/watch?v=_rQ7X1uPhsg	How to pick an IT rack
	UNIT 2.2: Process of Carrying Out the Installation of 5G Devices	2.2.2 Important of 5G Resources, Such as Power Circuits and Cooling Equipment	https://www.youtube.com/watch?v=ASHRVx3tkDY	Working Principle of Chiller Plant

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
		2.2.9 Process of Arranging Racks in a Hot-aisle/Cold-aisle Layout to Reduce Energy Use	https://www.youtube.com/watch?v=gzXUpmyQoRo	Cold Aisle Containment Installation
3. Process of Carrying out 5G Active Network Installation	UNIT 3.1: Process of Carrying Out a Power, Earthling and RF Cabling	3.1.1 Process of installing earthing cables to the earth source	https://www.youtube.com/watch?v=5RzEi-15WKA&t=211s	Earthing System
		3.1.2 Process of Installing Power Cables Between the Equipment and Power Source to Ensure Power Supply to the Equipment	https://www.youtube.com/watch?v=f0k2aUizj4s	Cable Termination In Panel
	UNIT 3.2: Process of Installation and Commissioning Backhaul Connectivity	3.2.2 Use of Fiber Optic for Backhaul Connectivity for the 5G Network	https://www.youtube.com/watch?v=CMAmyH229D4	C-RAN Architecture
		3.2.5 Steps involve in configuring gNodeB to the Centralised Unit (CU)	https://www.youtube.com/watch?v=sWSe9KOLyM0	What is gNodeB?

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
4. Process of Following the Occup-ational Health and Safety Instru-ctions during Tower Climbing	UNIT 4.1: Pre-climbing Tower Inspection	4.1.2 Availability of Well-maintained Safety Equipment Before Climbing Towers	https://www.youtube.com/watch?v=r3X71UgHP-jM&t=359s	Cell Tower Technician Training
		4.1.3 PPE for Tower Climbing	https://www.youtube.com/watch?v=KA8-53OGe9g	NATE Climber Connection

NCVET
कौशल गुणवत्ता प्रगति

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

Telecom Sector Skill Council

Telecom Sector Skill Council
Estel House,3rd Floor, Plot No: - 126, Sector-44
Gurgaon, Haryana 122003
Phone: 0124-2222222
Email: tssc@tsscindia.com
Website: www.tsscindia.com