

32. Recommended Practice for Voice/Data Carrier Transmission System Inspection, Testing and Maintenance

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Abstract: This recommended practice provides guidelines for inspecting, testing, and maintaining rail transit voice/data carrier transmission systems.

Keywords: communication, digital PCM span line, inspection, maintenance, pulse code modulation, T1, T-carrier, voice/data carrier transmission system

Introduction

(This introduction is not a part of APTA RT-SC-RP-032-03, *Recommended Practice for Voice/Data Carrier Transmission System Inspection, Testing and Maintenance.*)

APTA rail transit safety standards and recommended practices represent an industry consensus on practices for rail transit systems to help achieve a high level of safety for passengers, employees, and the general public. This document was created by and for those parties concerned with its provisions; namely, rail transit systems (operating agencies), manufacturers, consultants, engineers, and general interest groups. This recommended practice provides guidelines for inspecting, testing, and maintaining rail transit voice/data carrier transmission systems.

APTA recommends this practice for:

- Individuals or organizations that inspect, maintain, and/or operate rail transit systems
- Individuals or organizations that contract with others for the inspection, maintenance, and/or operation of rail transit systems
- Individuals or organizations that influence how rail transit systems are inspected, maintained, and/or operated (including but not limited to consultants, designers, and contractors)

The application of any practices or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of how a rail transit system operates. In such cases, the government regulations override any conflicting practices this document recommends.

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Recommended Practice for Voice/Data Carrier Transmission System Inspection, Testing and Maintenance

1. Overview

1.1 Scope

This document establishes recommended guidelines for inspecting, testing, and maintaining rail transit voice/data carrier transmission systems.

1.2 Purpose

The purpose of this recommended practice is to verify that voice/data carrier transmission systems and equipment are operating safely and as designed through periodic inspection, testing, and maintenance, thereby increasing reliability and reducing the risk of hazards and failures.

2. Definitions and acronyms

For the purposes of this recommended practice, the following definitions and acronyms apply:

2.1 Definitions

2.1.1 hazard: Any real or potential condition that can cause injury, death, or damage or loss of equipment or property.

2.1.2 operations control center (OCC): A location or locations designed, equipped, and staffed for the purposes of monitoring and controlling RTS activities from a central location or locations.
Syn: **rail control center, rail operations center, rail service control center.**

2.1.3 original equipment manufacturer (OEM): The enterprise that initially designs and builds a piece of equipment.

2.1.4 personal protective equipment (PPE): All clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, blast shields, hard hats, hearing protectors, gloves, respirators, aprons, and work boots.

2.1.5 pulse code modulation (PCM) span line: A system that provides a metallic transmission medium between two PCM multiplexed terminals and provides a transmission path for PCM carrier systems.

2.1.6 rail transit system (RTS): The organization or portion of an organization that operates rail transit service and related activities. *Syn:* **operating agency, operating authority, transit agency, transit authority, transit system.**

2.1.7 voice/data carrier transmission system: A multi-channel communication device used for the transmission and reception of voice and data.

2.2 Acronyms

OCC	operations control center
OEM	original equipment manufacturer
PCM	pulse code modulation
PPE	personal protective equipment
RTS	rail transit system

3. Inspection and testing provisions

3.1 Inspection and testing frequency

The inspection, testing, and maintenance procedures in this recommended practice should be performed

- a) when voice/data carrier transmission systems are placed in service
- b) when voice/data carrier transmission systems are modified, repaired, or disarranged
- c) at the frequencies recommended in Table 1 below
- d) as otherwise deemed necessary by the RTS

Table 1 – Inspection, testing, and maintenance frequency

Action	Recommended frequency (minimum)
Operational/inspections	Monthly (every 30 days)
Mechanical	Monthly (every 30 days)
Electrical	Monthly (every 30 days)
Cleaning/coating	Annually
Lubrication	As required

The RTS should determine the need for additional inspection, testing, and maintenance frequencies for voice/data carrier transmission systems. A review of the following factors may be useful in making this assessment:

- OEM-recommended intervals

- Industry experience
- Operating environment/conditions
- Historical data
- Reliability-centered maintenance program development
- Failure analysis
- RTS testing and experience
- Regulatory requirements

The frequency of tasks should comply with applicable federal, state, and local regulations.

3.2 Training

The RTS and/or their maintenance contractors should develop and execute training programs that provide employees with the knowledge and skills necessary to safely and effectively perform the tasks outlined in this recommended practice.

3.3 Materials

The following materials are recommended for inspecting, testing, and maintaining voice/data carrier transmission systems:

- RTS-approved cleaning and lubrication materials
- Additional materials as required by the OEM and/or RTS

3.4 Tools

The following tools are recommended for inspecting, testing, and maintaining voice/data carrier transmission systems:

- Multi-meter*
- Electrostatic discharge protection equipment
- PCM error counter
- Span and repeater test set
- Cable tester (mega ohm meter)*
- Oscilloscope*
- Patch cords

- RTS-approved portable radio
- Standard tools carried by maintenance personnel
- Additional tools as required by the OEM and/or RTS

* Calibrate in accordance with OEM and/or RTS requirements.

3.5 Personal protective equipment

Personal protective equipment, as required by the RTS, should be worn at all times during inspection, testing, and maintenance.

3.6 Safety

RTS safety rules, procedures, and practices shall be followed at all times during inspection, testing, and maintenance.

3.7 Inspection, testing and maintenance procedures

Voice/data carrier transmission system inspection, testing, and maintenance may be modified for each rail transit system's requirements but should contain the steps listed in Sections 3.7.1-3.7.2 as a minimum.

3.7.1 Inspection

3.7.1.1 General inspection

- 3.7.1.1.1** Notify the operations control center (OCC) and/or other authorities of the inspection activities to be performed.
- 3.7.1.1.2** Inspect each piece of voice/data carrier transmission system equipment for proper condition and operation.
- 3.7.1.1.3** Follow RTS electro-static discharge protection procedures to prevent damage to the equipment.
- 3.7.1.1.4** For voice/data carrier transmission system, check for errors on span line. Ensure error rate is less than 1×10^{-6} . This is the maximum error rate permissible for good voice transmissions.
- 3.7.1.1.5** Test span line automatic protection switch for proper operation.
- 3.7.1.1.6** Test systems used to diagnose specific span line segments.
- 3.7.1.1.7** Notify the OCC and/or other authorities when inspection is complete.

3.7.1.2 Mechanical inspection

- 3.7.1.2.1 Notify the OCC and/or other authorities of the inspection activities to be performed.
- 3.7.1.2.2 Ensure that all connections are secure and that there are no missing or damaged support brackets, fasteners and mounting hardware;
- 3.7.1.2.3 Inspect all enclosures to ensure proper sealing to prevent moisture leakage.
- 3.7.1.2.4 Notify the OCC and/or other authorities when inspection is complete.

3.7.1.3 Electrical inspection

- 3.7.1.3.1 Notify the OCC and/or other authorities of the inspection activities to be performed.
- 3.7.1.3.2 Inspect cabling and wiring to ensure that it is not frayed, burned, broken, cut, or otherwise defective.
- 3.7.1.3.3 Inspect cables to ensure they do not exceed their normal bending radius and are positioned to prevent chafing or cutting.
- 3.7.1.3.4 Inspect all electrical connections for signs of corrosion, broken wires, broken connections, missing hardware, loose connections, frayed or burned wires, defective insulation and moisture.
- 3.7.1.3.5 Inspect all fuses and other electrical protection equipment for burned, separated or otherwise damaged elements and replace as required.
- 3.7.1.3.6 Perform a system self diagnostics and loop back tests.
- 3.7.1.3.7 Notify the OCC and/or other authorities when inspection is complete.

3.7.2 Maintenance

- 3.7.2.1 Notify the OCC and/or other authorities of the maintenance activities to be performed.
- 3.7.2.2 Open each PCM span line housing enclosure and inspect for signs of moisture, heat discoloration or damage.
- 3.7.2.3 Perform cleaning procedures as required by OEM and/or RTS.
- 3.7.2.4 Apply corrosion inhibitor to mounting hardware as required by OEM and/or RTS.
- 3.7.2.5 Lubricate moving parts as required by OEM and/or RTS.
- 3.7.2.6 If applicable, simulate failure of primary system and verify operation of back up systems.
- 3.7.2.7 Return system to normal mode of operation.

3.7.2.8 Notify the OCC and/or other authorities when maintenance activities are complete.

3.8 Correction of deficiencies

Deficiencies identified during voice/data carrier transmission system inspection, testing, and maintenance should be corrected and documented in accordance with OEM and/or RTS requirements.

3.9 Documentation

Inspection, testing, and maintenance activities should be documented, reviewed, and filed in accordance with RTS procedures.

Annex A

(informative)

Bibliography

- [B1] Original equipment manufacturer (OEM) specifications for voice/data carrier transmission system inspection, testing, and maintenance.
- [B2] Rail transit system (RTS) procedures for voice/data carrier transmission system inspection, testing, and maintenance.