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Interface Practices Subcommittee

SCTE STANDARD

SCTE 109 2024

Test Procedure for Common Path Distortion (CPD)

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Document Tags

☐ Specification	☐ Checklist	☐ Facility
☒ Test or Measurement	☐ Metric	☒ Access Network
☐ Architecture or Framework	☐ Cloud	☐ Customer Premises
☒ Procedure, Process or Method		

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1. Introduction

1.1. Executive Summary

Reliable operation of today's two-way cable networks is critical, especially considering that upstream transmission in the return path includes telephone, high-speed data, and various telemetry and other signals. Common path distortion is a type of impairment that can affect the quality of those upstream signals. This document describes test procedures for the characterization of CPD in lab and field environments.

1.2. Scope

The purpose of this document is to establish the standard methodology used to measure common path distortion (CPD) in cable systems.

Please note that this procedure is a very unique procedure for measuring common path distortion and distinguishes itself from other similar procedures in the following ways:

- Single port measurement, measures reflected energy.
- Inject two forward carriers separated by the typical analog channel spacing frequency and measure return beat at the channel spacing frequency. For example, in North America, inject two forward carriers separated by 6 MHz and measure the return beat at 6 MHz.
- Used to verify performance of single port passives such as terminators or passives with all other ports terminated. Designed to be consistent with the mechanisms that cause common path distortion in outside plant.
- A procedure is included to extend the test method to a live cable network, involving the injection of forward carriers at certain frequencies in the headend/hub, and measuring a return beat (or beats) at a headend/hub upstream test point.

This procedure is valid for devices that are segmented into classifications as follows:

- Class 3: Products that meet specifications through 1794 MHz
- Class 2: Products that meet specifications through 1218 MHz
- Class 1: Products that meet specifications through 1002 MHz

1.3. Benefits

This document describes standard methodology that can be used for characterizing CPD in a lab and field environment. In particular, the lab method is unique in that it supports CPD characterization of single-port devices. An extension of the lab method intended for use in a live cable network can be thought of as treating the entire network as a single-port "black box" of sorts. The procedures in this document can augment other CPD test and measurement techniques used by the cable industry.

1.4. Intended Audience

The intended audience for this document includes technicians, engineers, and others with an interest in measuring CPD in a lab environment and/or in a live cable network.

1.5. Areas for Further Investigation or to be Added in Future Versions

One suggested area for further investigation is follow-up field evaluation of the method described in Section 9.3 Live Plant Third Order CPD Test.

2. Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. The editions indicated were valid at the time of subcommittee approval. All documents are subject to revision and, while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

[SCTE 144] ANSI/SCTE 144 2023, Test Procedure for Measuring Transmission and Reflection

2.2. Standards from Other Organizations

No normative references are applicable.

2.3. Other Published Materials

No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

Each of these procedures targets a different measurement for a unique purpose. They are independent, are specifically applicable to the device being measured, use the test equipment commonly available at the manufacturing sites used to make the device being tested, and directly measure the impairment that must be controlled. The key differences are whether they are designed for actives or passives and whether they are single port or two port measurements. Other differences are the types of distortion products being measured and the filters required to do so.

3.1. SCTE References

[SCTE 115] ANSI/SCTE 115 2019, Test Method for Reverse Path (Upstream) Intermodulation Using Two Carriers

[SCTE 126] ANSI/SCTE 126 2019, Test Method for Distortion of 2-way Active Amplifier Caused by Insufficient Isolation of Built in Diplex Filter

[SCTE 145] ANSI/SCTE 145 2022, Test Method for Second Harmonic Distortion of Passives Using a Single Carrier

3.2. Standards from Other Organizations

No informative references are applicable.