SCTE · ISBE

STANDARDS

Interface Practices Subcommittee

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Attenuation of Common Mode Filters

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1. Introduction

1.1. Executive Summary

Interference from devices or the environment can travel along the outer conductor of a coaxial cable as a common mode current. This current creates a common mode disturbance that can impact the upstream integrity of a cable plant. SCTE 249 is the test method used by the cable industry for measuring the amplitude and frequency of these disturbances.

Common mode filters (or attenuators) can be used to attenuate the amplitude of these disturbances. This test method creates an industry accepted standard for testing the attenuation of these common mode filters.

1.2. Scope

All common mode filters or attenuators up to 230 MHz in frequency (limited by the upper frequency cutoff of commercially available coupling-decoupling networks) can be characterized using this test method.

1.3. Benefits

This test method provides an industry accepted standard for testing the effectiveness of common mode filters.

1.4. Intended Audience

Cable industry.

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

Expand scope and testing methodology to include devices that provide active filtering or cancellation of common mode disturbance.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. 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 249 Test Method Common Mode Disturbance

2.2. Standards from Other Organizations

- CISPR 22:2008 (EN55022:2010) Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

- CISPR 16-1-1 Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus
- IEC 61000-4-6 Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields

2.3. 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.

- No informative references

3.1. SCTE References

- No informative references are applicable.

3.2. Standards from Other Organizations

- No informative references are applicable.

3.3. Published Materials

- No informative references are applicable.

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

CM	common mode
MHz	megahertz
ISBE	International Society of Broadband Experts
SCTE	Society of Cable Telecommunications Engineers
DUT	device under test

6. Required Information

This document is a general test method. It is designed for use in many different situations. As such, it is written to be only as specific as is necessary. The missing specific details necessary to perform this test are referred to as "Required Information." The "Required Information" is to be provided by the customer.

The information required to perform this test method includes, but is not limited to:

- definition of a Device Under Test (DUT)
- the required number of DUTs
- frequency range(s) across which the test is to be performed
- the environmental conditions (temperature, humidity, etc.) at which the tests shall be performed
- the acceptance criterion

7. Discussion

CM filters may exist in the form of discrete chokes, or integrated into cables or other devices. This test method provides a way to measure the effectiveness of these filters by measuring the attenuation over frequency of these filters.

8. Equipment Requirements

Table 1 – Equipment Requirements

Item	Qty	Description
a.	1	Vector Network Analyzer
b.	2	CDN with coaxial interface, such as the Teseq CDN S751A (injection clamps may be used in place of the CDN)
c.	2	50 ohm N to BNC cable (connection from vector network analyzer to CDN)
d.	2	50 ohm BNC to 75 ohm F adapter

9. Preparation

Vector Network Analyzer Settings:

- Sweep Range (start/stop frequency) = 100 kHz to 50 MHz

Setup and verification

1. Setup equipment as shown in Figure 1

2. Connect a coax jumper (no CM filter) as DUT
3. CDN's (or injection clamps)
    a. Terminate the AE port of the S751A with a 75 ohm terminator
    b. Install a 75 ohm BNC to 75 ohm F female adapter on the DUT port of the CDN S751A
    c. Use N to BNC jumpers to connect the measurement ports of the CDN's to the RF ports of the VNA
4. Measure the insertion loss of the coax jumper and save in trace memory as the reference trace. Setup trace math to subtract the memory trace from the active trace (alternatively, use the coax jumper to calibrate the insertion loss – this results in 0 dB insertion loss with the coax jumper).

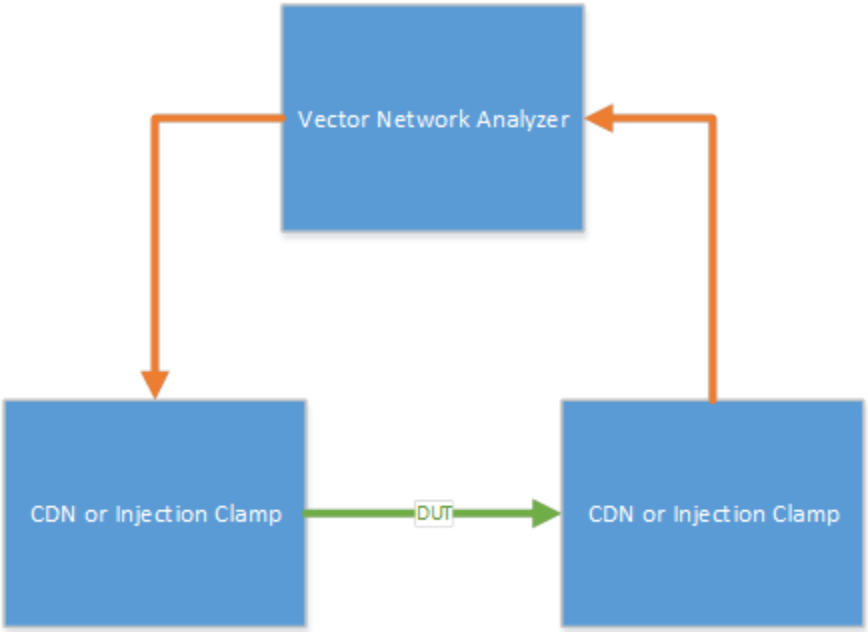

Figure 1 - Equipment Setup

10. Procedure

1. Replace the coaxial cable in section 9 with the DUT (i.e., coaxial cable with CM filter) as shown in Figure 1
2. Record the delta between the active trace on the VNA and the memory trace (from section 9) as the attenuation of the DUT (CM filter). See Figure 2 for example.

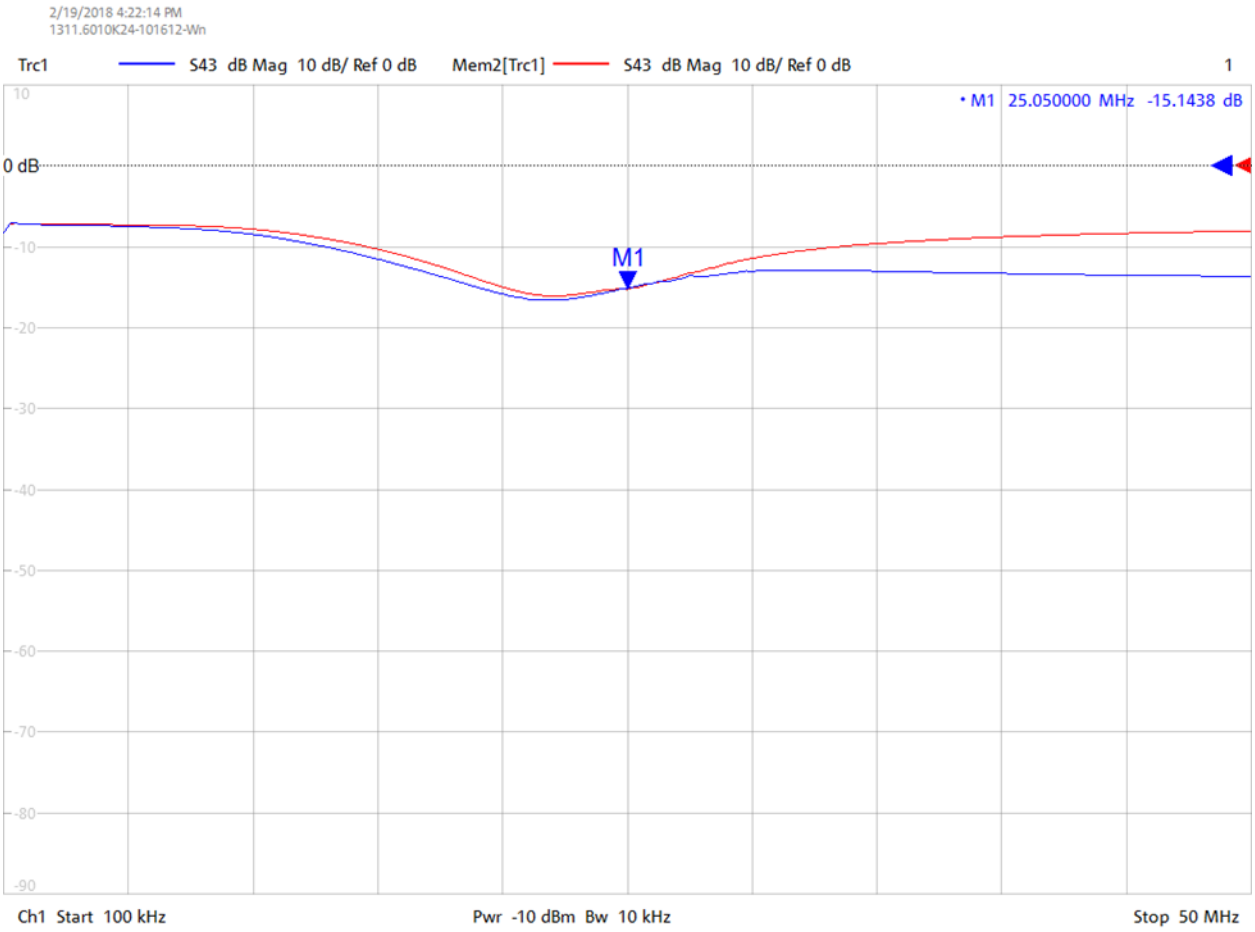

Figure 2 - S-Parameter of CM Filter (Blue Trace) vs No Filtering (Red Trace)