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Network Operations Subcommittee

SCTE STANDARD

SCTE 257 2024

**Techniques for Accurate Measurement of Cable TV
Network Downstream RF Signal Levels**

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Document Tags

☐ Specification	☐ Checklist	☐ Facility
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☐ Architecture or Framework	☐ Cloud	☐ Customer Premises
☒ Procedure, Process or Method		

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Table of Contents

Title	Page Number
NOTICE.....	2
Document Tags.....	3
Document Release History	3
Table of Contents	4
1. Introduction.....	6
1.1. Executive Summary	6
1.2. Scope	6
1.3. Benefits	6
1.4. Intended Audience	7
1.5. Areas for Further Investigation or to be Added in Future Versions.....	7
2. Normative References	7
2.1. SCTE References	7
2.2. Standards from Other Organizations	7
2.3. Published Materials	7
3. Informative References	7
3.1. SCTE References	7
3.2. Standards from Other Organizations	7
3.3. Published Materials	8
4. Compliance Notation	8
5. Abbreviations and Definitions.....	8
5.1. Abbreviations.....	8
5.2. Definitions.....	9
6. Downstream Signal Level Measurements	10
6.1. General RF Signal Level Measurements	10
6.2. Accuracy Versus Precision	11
6.3. Lab-Grade versus Field-Grade Measurement Devices	13
6.4. A Closer Look at Factors Contributing to Measurement Inaccuracy	14
6.4.1. Signal source output signal level tolerance	14
6.4.2. Signal source RF signal level stability	14
6.4.3. Signal source calibration (if applicable)	14
6.4.4. Interconnection net attenuation.....	15
6.4.5. Measurement device accuracy	15
6.4.6. Measurement device calibration	15
6.4.7. Impedance mismatches	15
6.4.8. Frequency response	16
6.4.9. Temperature.....	16
6.4.10. Single channel per port versus multiple channels per port.....	16
6.5. Assumption Errors.....	18
6.6. Tips for More Accurate Measurements.....	19
6.7. Signal Source Configuration	20
7. Signal Level Measurement Examples.....	21
7.1. Example 1	21
7.2. Example 2	22
8. Conclusion.....	23
9. Appendix	24
9.1. How to Calculate Base 2 Logarithms.....	24
9.1.1. Base 10 logarithm method.....	24
9.1.2. Natural logarithm method.....	24

List of Figures

Title	Page Number
Figure 1 - Is the reported digital channel power of 56.7 dBmV the actual digital channel power?.....	6
Figure 2- Basic signal level measurement setup	11
Figure 3 - This five-shot target grouping is precise but not accurate.....	12
Figure 4 - This five-shot target grouping is both precise and accurate.....	12
Figure 5 - This five-shot target grouping is neither precise nor accurate.	13
Figure 6 - Amplitude ripple can affect levels from channel to channel.	16
Figure 7 - Excerpt from DRFI.....	17
Figure 8 - 75 ohm mini-coax maximum cable attenuation versus frequency (data derived from ANSI/SCTE 117 2018).....	19
Figure 9 - Example of maximum attenuation versus frequency for Series 59 headend coaxial cable	19
Figure 10 - Block diagram for Example 1.....	21
Figure 11 - Block diagram for Example 2.....	22

List of Tables

Title	Page Number
Table 1- Example per-channel signal levels in a cable network.....	11
Table 2 -Two-way splitter insertion loss.....	18
Table 3 - Parameters for Example 1	21
Table 4 - Parameters for Example 2.....	22

1. Introduction

1.1. Executive Summary

Measurement of a cable network's downstream radio frequency (RF) signal levels is often taken for granted. The procedure is straightforward: Connect a signal level meter (SLM), spectrum analyzer, or similar instrument to the device or signal source being measured and read the reported signal level (see **Figure 1**). But is the reported value the actual value? Not necessarily. There are several factors that affect the accuracy of measured and reported RF signal levels. This Operational Practice discusses those factors, and how to achieve more accurate and repeatable results.¹

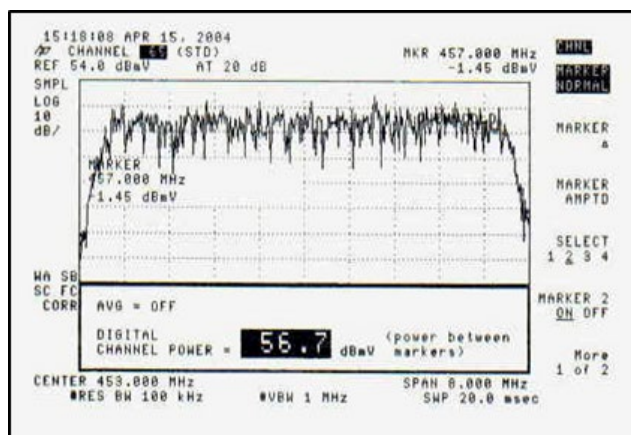


Figure 1 - Is the reported digital channel power of 56.7 dBmV the actual digital channel power?

1.2. Scope

Proper cable network operation relies upon RF signal levels being within specification. RF signals are just about everywhere in modern cable systems: antenna sites, headends, hub sites, nodes, coax distribution networks, and subscriber drops. While ensuring that signal levels are what they're supposed to be won't fix or avoid every problem, correct signal levels are an important part of optimizing overall RF performance.

1.3. Benefits

Optimum cable network downstream performance requires that RF signal levels be measured and set correctly. RF signal levels affect nearly every part of a cable network's operation: headend/hub site, optical fiber links, coax distribution, subscriber drops, and customer premises equipment (CPE). This Operational Practice discusses measurement of downstream signal levels, factors that can affect the accuracy of those measurements, and provides recommendations to ensure correct RF signal levels.

¹ The content of this Operational Practice is based upon a three-part article written by Ron Hranac, which appeared in the Fall 2017, Winter 2017, and Spring 2018 issues of *Broadband Library* magazine (<https://broadbandlibrary.com/>). The material is used with the permission of the author.

1.4. Intended Audience

This document is intended for cable system technical personnel such as installers, service and maintenance technicians, headend and hub site technicians, and others who have to measure signal levels as part of their daily jobs, or are interested in the measurement of signal levels.

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

Future versions of this Operational Practice (or a new and separate Operational Practice) could include information about the measurement of upstream RF signal levels. Another idea for future versions is to add more information about measurement of the downstream spectrum at the output of an active device, when there is a significant amount of positive tilt (slope) across the operating bandwidth. Should a future version of this Operational Practice include information about upstream signal level measurements, emphasis on the measurement of bursty signals could be considered, along with ideas for accessing the return path for measurements without causing interruptions. (As previously mentioned, upstream measurements might be more suitable in a separate Operational Practice).

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

- No normative references are applicable.

2.2. Standards from Other Organizations

- No normative references are applicable.

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.

3.1. SCTE References

[SCTE 183] SCTE 183 2023: Measurement Recommended Practices for Cable Systems.

3.2. Standards from Other Organizations

[1] ISO 5725-1:1994 “Accuracy (trueness and precision) of measurement methods and results -- Part 1: General principles and definitions”

3.3. Published Materials

- [2] Data-Over-Cable Service Interface Specifications Downstream RF Interface Specification CM-SP-DRFI-I15-160602 (<http://www.cablelabs.com/wp-content/uploads/specdocs/CM-SP-DRFI-I15-160602.pdf>)
- [3] “Fundamentals of RF & Microwave Power Measurements,” Agilent Application Note 64-1C (<http://cp.literature.agilent.com/litweb/pdf/5965-6630E.pdf>)
- [4] “Power Measurement Basics,” Agilent PowerPoint presentation (http://www.keysight.com/upload/cmc_upload/All/BTB_PowerBasics_2005.pdf)
- [5] “Spectrum Analyzer Basics,” Agilent Application Note 150 (https://www.keysight.com/upload/cmc_upload/All/5952-0292EN.pdf)

4. Compliance Notation

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5. Abbreviations and Definitions

5.1. Abbreviations

AC	alternating current
AGC	automatic gain control
CMTS	cable modem termination system
CPE	customer premises equipment
CTA	Consumer Technology Association
dB	decibel
dBmV	decibel millivolt