SMPTE RECOMMENDED PRACTICE

Cinema Sound System Baseline Setup and Calibration

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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual. This SMPTE Engineering Document was prepared by Technology Committee 25CSS.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Recommended Practice. However, attention is drawn to the possibility that some of the elements of this document might be subject to patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This introduction is informative and does not form an integral part of this Engineering Document.

The motion picture industry is unique in having a creation and distribution model whereby a movie is mixed and played back in potentially different environments that are calibrated to the same set of standards and are intended to reproduce similarly. The goal is to ensure that the audio heard in the playback theater/cinema matches that heard in the mix room/dubbing theater where the program material was created. Experience gained among its members has resulted in procedures to ensure that sonic match, many of which have never been documented.

The two primary criteria defining the audio environment are frequency response and level. Currently, the cinema sound system B-chain's electroacoustic frequency response is defined in ST 202 "Dubbing Stages (Mixing Rooms), Screening Rooms and Indoor Theaters — B-Chain Electroacoustic Response", with level defined in RP 200 "Relative and Absolute Sound Pressure Levels for Motion-Picture Multichannel Sound Systems — Applicable for Analog Photographic Film Audio, Digital Photographic Film Audio and D-Cinema".

The "Modern Digital Cinema Calibration" Recommend Practices, RP 2096-1 and RP 2096-2, expand on those two documents by providing a set of current 'best practices' methodology to better serve the above-stated goals and intentions, emphasizing contemporary fast Fourier transform (FFT) technology that is capable of transfer function analysis. The suite does not define new standards or supersede current ones, but offers current approaches and methodology using modern equipment to more accurately calibrate within the tolerances of the existing standards.

This "Baseline Calibration" Recommended Practice codifies a single set of procedures culled from current practices by experienced technicians to rigorously troubleshoot, calibrate and create detailed documentation for a dubbing theater or cinema. This provides a baseline for that theater that can be used for future "Maintenance Calibrations" and troubleshooting.

1 Scope

This document provides a single set of processes to complete baseline calibration and documentation of sound systems in dubbing stages (mixing rooms), screening rooms, and commercial cinemas to improve the consistency of reproduction, from room to room, of motion picture sound. This set of processes also provides a means to maintain sound system calibration in the future.

For normal repeat calibrations, please refer to SMPTE RP 2096-2, a substantially streamlined procedure which will call upon data collected during this baseline calibration procedure to ensure measurement consistency.

2 Conformance Notations

Normative text is text that describes elements of the design that are indispensable or contain the conformance language keywords: “shall”, “should”, or “may”. Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting this Engineering Document’s requirements, specifications, procedures, or interoperability with other SMPTE Engineering Documents. Informative text does not contain conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as “Informative” or individual paragraphs that start with “Note:”

The keywords “shall” and “shall not” indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, “should” and “should not” indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords “may” and “need not” indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions (“shall”) and, if implemented, all recommended provisions (“should”) as described. A conformant implementation need not implement optional provisions (“may”) and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; then formal languages; then figures; and then any other language forms.

3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this engineering document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this engineering document are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

1. ANSI/ASA S1.11-2004 (R2009), “Octave-Band and Fractional-Octave-Band Analog and Digital Filters”.
2. ANSI/ASA S1.40-2006 (R2011), “Specifications and Verification Procedures for Sound Calibrators”.
3. ANSI/ASA S12.2-2008, “Criteria for Evaluating Room Noise”.
4. IEC 60942:2003, “Electroacoustics — Sound Calibrators”.
5. IEC 61260-1 Edition 1.0 B:2014, “Electroacoustics — Octave-band and fractional-octave-band Filters - Part 1: Specifications”.
6. IEC 61672-1, “Electroacoustics — Sound Level Meters — Part 1: Specifications”.
7. SMPTE RP 200:2012, “Relative and Absolute Sound Pressure Levels for Motion Picture Multichannel Sound Systems — Applicable for Analog Photographic Film Audio, Digital Photographic Film Audio and D-Cinema”.
8. SMPTE ST 202:2010, “Dubbing Stages (Mixing Rooms), Screening Rooms and Indoor Theaters — B-Chain Electroacoustic Response”.
9. SMPTE ST 2095-1:2015, “Calibration Reference Wideband Digital Pink Noise Signal”.

4 Terms and Definitions

B-chain — The portion of the sound system in a cinema space that reproduces the soundtrack in the theatre. It includes signal processing specific to the loudspeakers, and power amplifiers of the screen channels, surround channels, and low frequency effects (LFE) channel. It also includes the screen and the theatre acoustics.

dB — decibel.

DFT — discrete Fourier transform. The FFT is a subset of the DFT.

EQ — equalization.

FFT — fast Fourier transform.

Flat Response — A term that describes a system’s frequency response wherein the level across the frequency range of interest is essentially uniform and is within certain bounds, sometimes taken as ±0 dB, but in practice is within a defined tolerance.

Free-Field Microphone — Free-field microphones are pressure microphones that have been ‘corrected’ to give a flat response when pointed at the sound source (i.e., the sound arrives on-axis to the microphone). The ‘correction’ compensates for the microphone’s disturbing presence in the soundfield and associated high frequency buildup. With this orientation it measures the sound pressure at the diaphragm as it would appear if