Loudness, dialnorm, the CALM Act, and other things audio

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PBS
Let’s begin Calmly

CALM Act:
(a) RULEMAKING REQUIRED.—Within 1 year after the date of enactment of this Act, the Federal Communications Commission shall prescribe pursuant to the Communications Act of 1934 (47 U.S.C. 151 et seq.) a regulation that is limited to incorporating by reference and making mandatory (subject to any waivers the Commission may grant) the “Recommended Practice: Techniques for Establishing and Maintaining Audio Loudness for Digital Television” (A/85), and any successor thereto, approved by the Advanced Television Systems Committee, only insofar as such recommended practice concerns the transmission of commercial advertisements by a television broadcast station, cable operator, or other multichannel video programming distributor.

(b) IMPLEMENTATION.—
(1) EFFECTIVE DATE.—The Federal Communications Commission shall prescribe that the regulation adopted pursuant to subsection (a) shall become effective 1 year after the date of its adoption.

(2) WAIVER.—For any television broadcast station, cable operator, or other multichannel video programming distributor that demonstrates that obtaining the equipment to comply with the regulation adopted pursuant to subsection (a) would result in financial hardship, the Federal Communications Commission may grant a waiver of the effective date set forth in paragraph (1) for 1 year and may renew such waiver for 1 additional year.

(3) WAIVER AUTHORITY.—Nothing in this section affects the Commission’s authority under section 1.3 of its rules (47 C.F.R. 1.3) to waive any rule required by this Act, or the application of any such rule, for good cause shown to a television broadcast station, cable operator, or other multichannel video programming distributor, or to a class of such stations, operators, or distributors.

(c) COMPLIANCE.—Any broadcast television operator, cable operator, or other multichannel video programming distributor that installs, utilizes, and maintains in a commercially reasonable manner the equipment and associated software in compliance with the regulations issued by the Federal Communications Commission in accordance with subsection (a) shall be deemed to be in compliance with such regulations.

(d) DEFINITIONS.—For purposes of this section—
(1) the term “television broadcast station” has the meaning given such term in section 325 of the Communications Act of 1934 (47 U.S.C. 325); and the terms “cable operator” and “multichannel video programming distributor” have the meanings given such terms in section 602 of Communications Act of 1934 (47 U.S.C. 522).
Extracted Points

• Within one year (by 12/15/11) FCC must make mandatory ATSC A/85 ...
  – “and any successor thereto”

• Only as it concerns the transmission of commercial advertisements by a television broadcast station, cable operator, or other multichannel video programming distributor.
A/85

**ATSC Recommended Practice:**
Techniques for Establishing and Maintaining Audio Loudness for Digital Television (A/85)

Extracted Points

• Regulation becomes effective one year after FCC adopts rules
• Stations, cable operators, and MVPDs may request a one-year extension based on financial hardship
  – Possible second one-year extension
Extracted Points

• Compliance means an operator “installs, utilizes, and maintains in a commercially reasonable manner the equipment and associated software in compliance with the regulations …”
Current ATSC Actions

“…successor thereto…”

• ATSC is slightly revising A/85
  – Developing a new **Annex J** that collects all of the elements of A/85 that relate to the CALM Act
  – Update the A/53 reference to 2010
    • Now includes BT.1770-2 Loudness Measurement
PTV & CALM Act

• CALM = “Commercial Advertisement Loudness Mitigation”

• Public television is prohibited from broadcasting commercial advertisements (therefore…)

• However, for the benefit of the viewing public all stations should follow A/85 as a matter of good practice
“Audio Golden Rule”

Your average **dialog level** must match your **dialnorm value**!
“The CALM Place” @ NAB

- ATSC Tech Zone – North Hall 4334 (near doors to Hilton)
  - Loudness measurement and management demos by:
    - Harris, DaySequerra/DTS, Dolby, IneoQuest, Linear Acoustic, NBC Universal, and others
  - Other demos on topics such as transmission efficiency improvement and 3D
TV Loudness
dialnorm vs. Dialog Level

- **dialnorm**
  - a metadata value
  - It has absolutely no relationship to any audio level *until you make the relationship*

- **Anchor Element**
  - “perceptual loudness reference point or element… that a reasonable viewer would focus on when setting the volume control.”
  [A/85-2009] → Usually this is the dialog
dialnorm vs. Dialog Level

- **Dialog Level**
  - loudness (in LKFS) of the Anchor Element
- **average Dialog Level**
  - level of the dialog averaged over a specific period of time
  - often over a program segment or a complete spot
  - PBS measures over the complete program
dialnorm vs. Dialog Level

- The broadcast industry has largely moved to -24 LKFS as the target dialog level
- PBS moved to this level about five years ago for both program submission and distribution
±2 dB: Target, not Tolerance!

- A/85 prescribes a target dialog level of -24 LKFS ± 2 dB
  - 2 dB allows for variations
  - Should not target the edge of this range
  - Should be concerned with “boundary” conditions – segment to segment
  - Should allow for maximum use of the dynamic range
Digital versus Analog

• A/85 is not intended to restrict the range but instead to fully use it while properly managing levels
• Analog had about 50 dB of dynamic range
• Digital has about 100 dB of dynamic range → Use it!
Production Tips

• Buy an LKFS meter (BS.1770-2)
  – Your mix engineers will like it!
• No money?
  – Dialog peaks at -10 dBFS works pretty well
• Produce content to -24 LKFS
  – Long-term average over entire show ± 2 dB
  – Dramatic or tender moments can still be ±10 dB or more!
Station Tips

• Set:
  – your plant for unity gain
  – emission encoder dialnorm value to -24
• Get an LKFS meter (BS.1770-2)
• Measure your services over a day and compare to -24 LKFS
• Apply processing if needed
• Compare with local stations and share
DRC (Dynamic Range Control)

• Six DRC profiles in AC-3
  – Film Light Often preferred for emission
  – Film Standard
  – Music Light
  – Music Standard
  – Speech
  – None

PBS distribution
DRC Curves
(from Dolby 569 manual)

Curves are set by Profile selection

Figure A-2 DRC Profile Pattern
Target Loudness

**Viewer Perception**

- **Annoyingly Loud!** +10.8 dB
- User turns volume down: +5.6 dB
- Louder, but Acceptable: +2.4 dB
- "Comfort Zone"
- Softer, but acceptable: -5.4 dB
- User turns volume up: -10.2 dB
- Annoyingly soft! -19.1 dB

**Comfort Zone:**
Determined through exhaustive subjective listening tests

Note the additional latitude on the softer side of the zone

**LKFS**

-11.2
-22
-24
-26
-43.1
Loudness Examples

- Within the Comfort Zone
  - Here’s an example at the **center** of the Comfort Zone
    (5.4 db below -24 LKFS)

**Centered on target**
Loudness Examples

• Within the Comfort Zone
  – Here’s an example at the lower end of the Comfort Zone (5.4 db below -24 LKFS)

Soft, but acceptable
Loudness Examples

• Within the Comfort Zone
  – Here’s an example at the upper end of the Comfort Zone
    (2.4 db above -24 LKFS)

Louder, but Acceptable
Loudness Examples

• Outside the Comfort Zone
  – Here’s an example 4.6 dB below the lower end of the Comfort Zone (10.2 db below -24 LKFS)

*User turns volume up*
Loudness Examples

• Outside the Comfort Zone
  – Here’s an example 3 dB above the upper end of the Comfort Zone (5.6 db above -24 LKFS)

User turns volume down
Lip Sync
Errors Can Hide Below Threshold

- **Scenario #1**
  - Program source: -1 frame, looks OK
  - Station broadcast: -1 frame, looks OK
  - Broadcasted Show: -2 frames, looks bad
- **Solution:** *All sync must be correct (don’t just look it)*

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Errors Can Cancel

• Scenario #2
  – Program source: -3 frames
  – Station broadcast: +3 frames
  – Broadcasted Show: 0 frames, looks good
  – But two wrongs don’t make a right!
  – Good shows will look bad on this station!

• Solution: *All sync must be correct*
Errors Can Drift

• Scenario #3
  – Broadcasted Show Now: Good
  – Broadcasted Show Later: Bad

• Solution: Be Careful! Change Channels!

• Millions of commercial and consumer MPEG decoders drift!
Error Perception Can Drift

• Scenario #4
  – Sync Now: looks good
  – Same Sync Later: looks bad

• Solution: Patience
  – Need tight shots of people talking
  – Some people talk out of sync!
  – Stare at sync long enough, you will start seeing things!
Station Production Tips

• Delay audio with *every* video delay
  – Framesyncs
  – Switcher effects
  – LCD & Plasma Displays!
  – Don’t trust your ears
  – TEST!
Station Master Control Tips

• Align sync at *every* point
  – Framesyncs & processors
  – MPEG & ATSC encoder settings
  – Surprises
  – Don’t trust your ears
  – TEST!
Test Tools

• Edit Suites and QC Stations
  – www.syncheck.com

• Station Master Control
  – ID with 1 frame dot and beep, then non-linear editor
  – Normal programming with Miranda or Evertz lip sync detection solutions
Consumer Tips

- LCD & Plasma TV's
  - Internal decoder *should* be OK
  - Separate decoder & audio systems require an offset – often a number of frames

- MPEG decoders
  - Lip sync error observed?
    -> try changing channels or interrupting the transport stream
5.1 Surround
5.1 Surround Submission

- PBS Requirement deferred beyond 2011
- Upmix is optional
  - Ensure you have a compatible downmix – vendor!
    - Most viewers are still listening to stereo
  - Ensure you have no negative side effects
- 5.1 Production
  - Ensure you have compatible downmix – engineer!
  - Traditionally all dialog in Center track only
  - Calibrate your LFE
5.1 Surround Broadcast

• Increasing Demand
  – Consumers are building theaters
  – PBS is encouraging and will be supplying more 5.1 content

• NGIS NRT eliminates this expense
  – Compelling 5.1 shows will arrive early via NRT
PCM Plant - SAP on 7/8
PCM Plant - SAP on 3/4
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(Thanks to Bruce Jacobs)

Discussion