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Date: March 16, 1994

From: Craig Todd

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Glenn Reitmeier	Sarnoff	609 734 2124
Jae Lim	MIT	617 253 7302
Bob Rast Woo Paik	General Instrument	619 535 2486

Gentlemen,

Here are copies of the slides which I will use in my presentation on Sunday.

I will be staying at the Riviera Hotel, arriving late Sat. nite and departing Sun. afternoon shortly after our session ends.

Craig Todd

Grand Alliance HDTV

Audio Subsystem

Dolby AC-3

Craig Todd
Dolby Laboratories
San Francisco

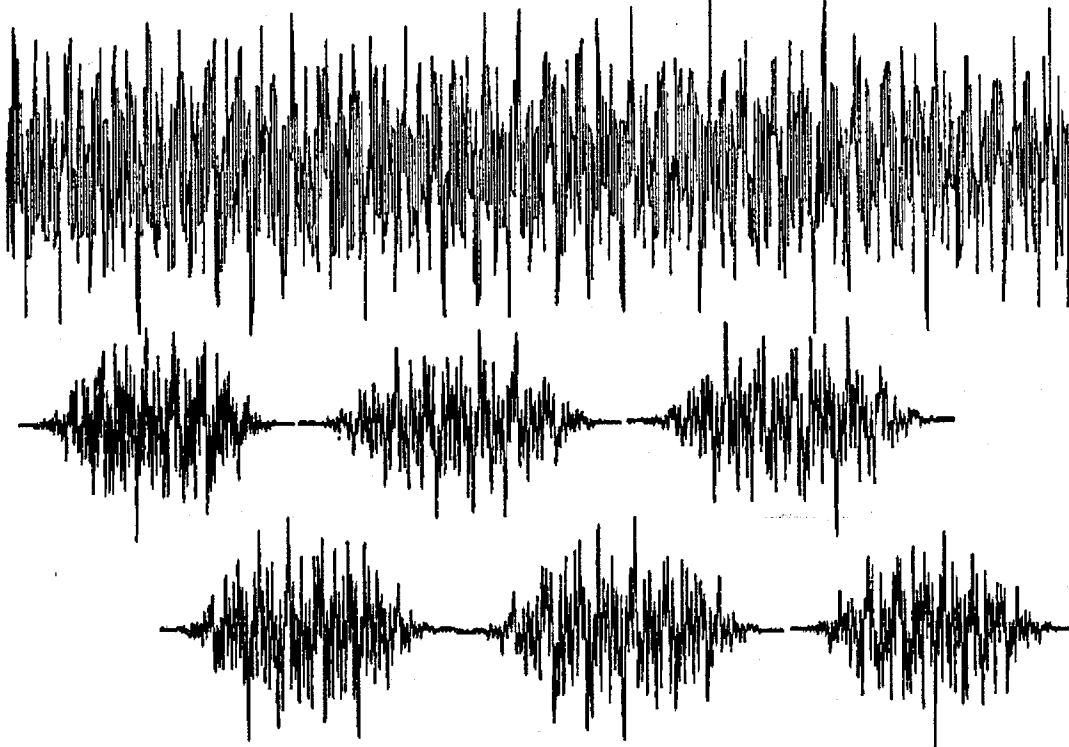
Today's Presentation

- What is AC-3?
- What can it do?

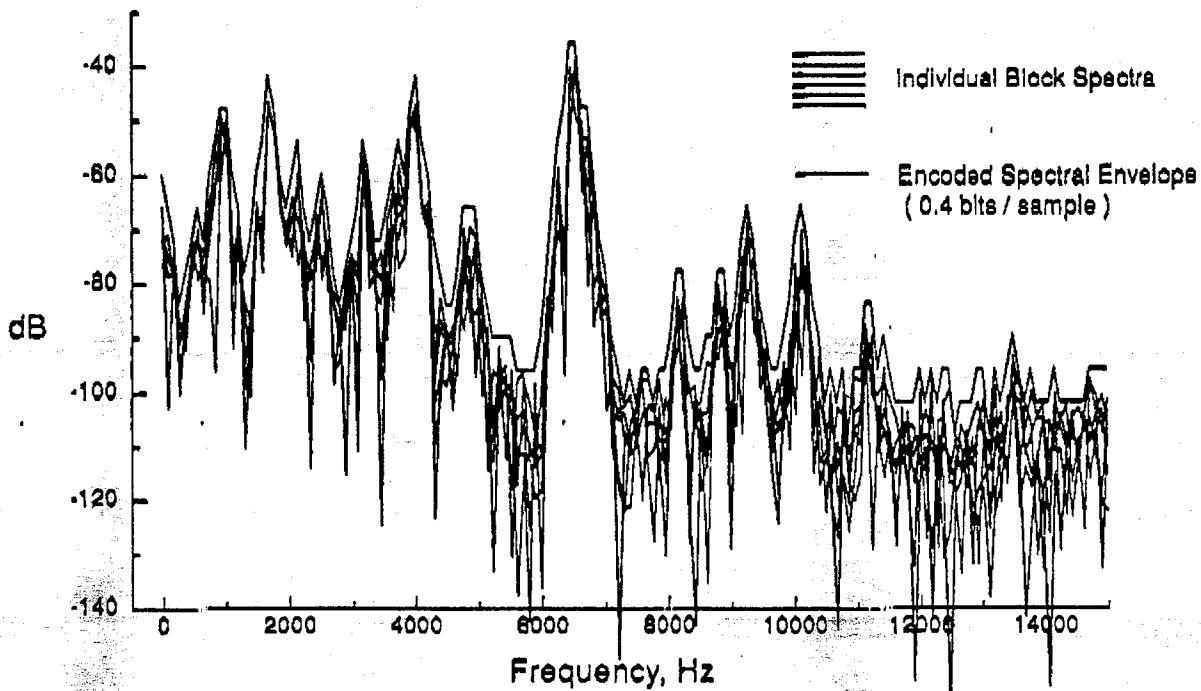
What Is AC-3?

- Frequency domain coder
- Encodes 1 to 5.1 channels
- Based on an efficient FFT filterbank
- Variable time/frequency resolution
- Psychoacoustic bit allocation
 - Common bit pool for all channels
 - Only audible signals are encoded
- High frequency coupling
 - Model and exploit high frequency localization
 - Provides additional coding gain for high frequencies
- High coding gain: < 2 bits / sample
- Future performance gains by encoder improvements

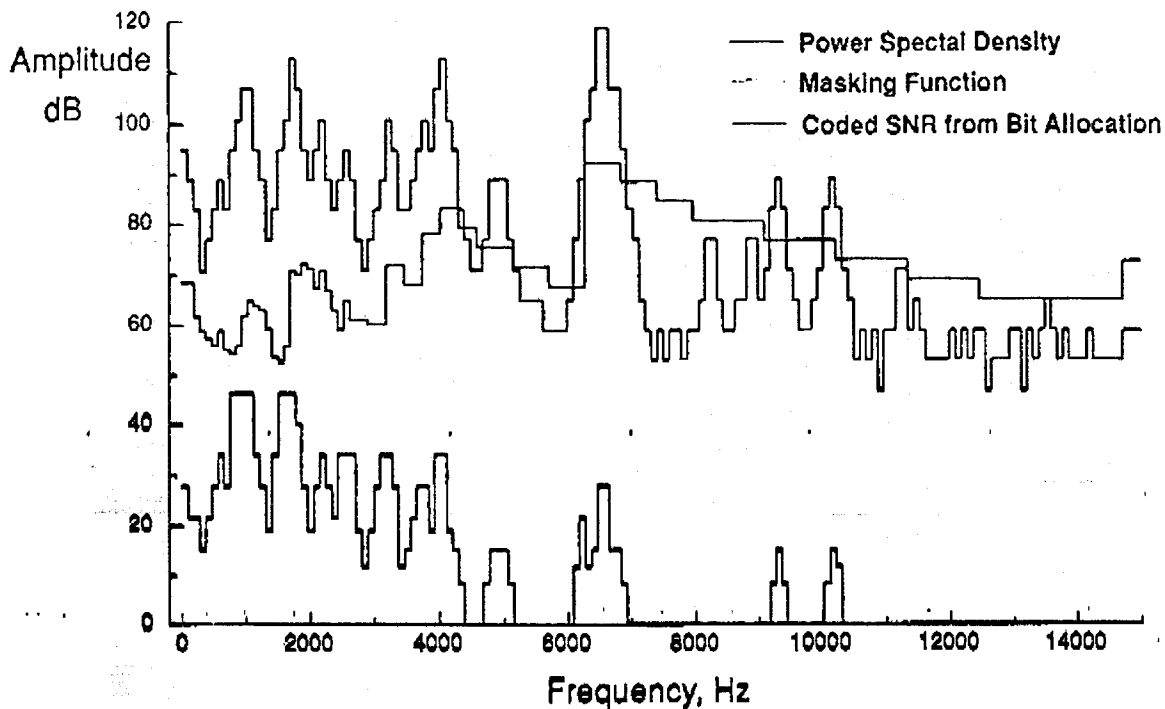
Windowing Six Blocks



Spectral Envelope Coding



Masking and Bit Allocation



5.1 Channel Sound

5.1 Channel format supported by:

- > SMPTE - Society of Motion Picture and Television Engineers
- > ATSC - Advanced Television Systems Committee
- > ITU - International Telecommunications Union
- > ACATS - Advisory Committee on Advanced Television Service
- > MPEG - Moving Pictures Experts Group

Supported Channel Arrangements:

Front / Rear Channels

- 1/0 Mono
- 2/0 Stereo
- 3/0 Three front channels
- 3/1 Three fronts, mono surround
- 3/2 Three fronts, stereo surround
(subwoofer channel optional)

Audio Service Types

➤ Main Service:

Complete audio program

➤ Associated Service:

Supplemental audio channel which may be combined with a main audio service

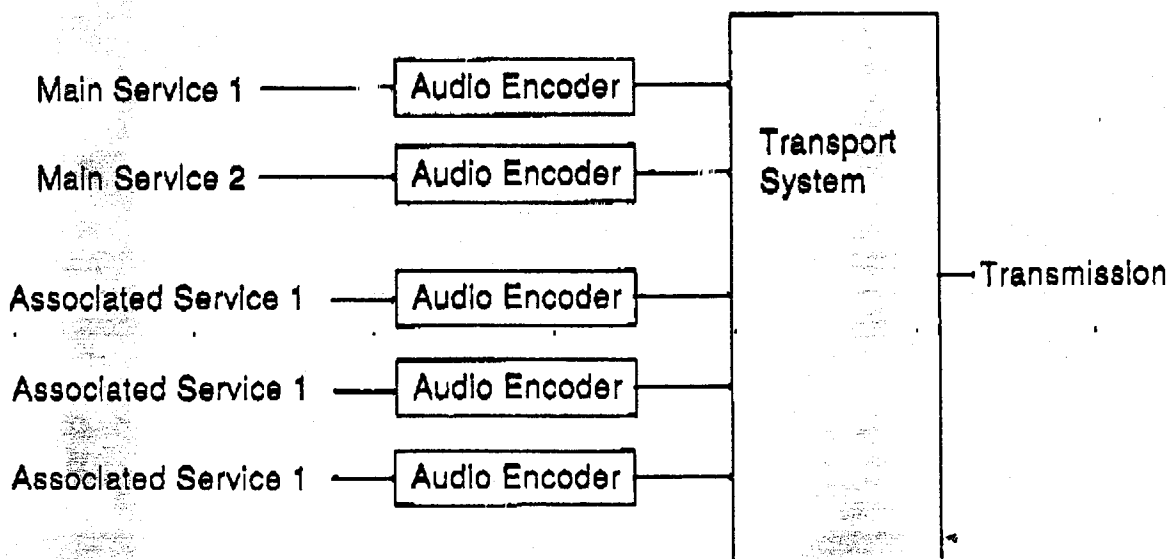
➤ Multiple main and associated services may be delivered

➤ Each service may be in any language

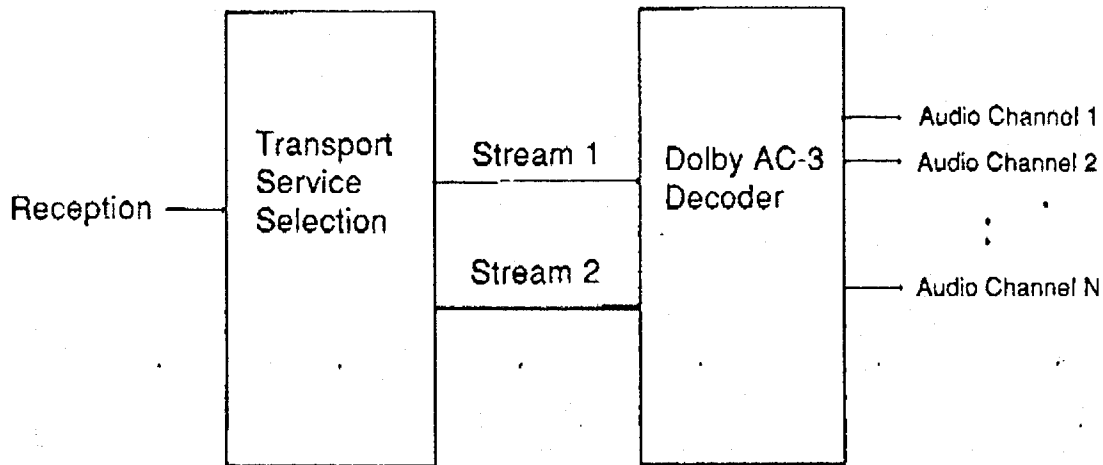
Associated Service Types

- **Visually Impaired:** Commentary describing the picture content
- **Hearing Impaired:** Clean dialog, processed for maximum intelligibility
- **Commentary:** Supplementary Information which may be combined into the main service
- **Emergency Message:** Emergency message given priority in reproduction

Transmission of Multiple Services



Reception of Two Services



Selected bit streams

Stream 1: Selected Main Audio Service

Stream 2: Selected Associated Audio Service

Dynamic Range

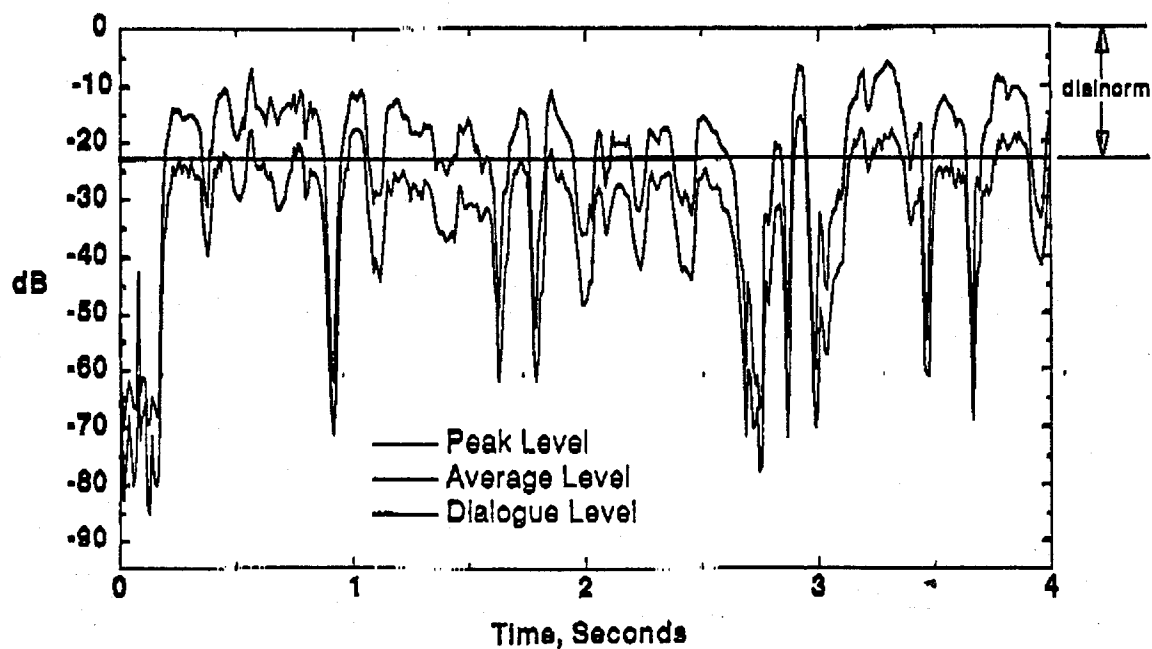
What to do with > 100 dB dynamic range?

- > Use compression to reduce the dynamic range for most listeners
- > Simultaneously provide full dynamic range to home theatre enthusiasts. Reproduction can catch that of 35mm cinema.
(Death Star explosion > 100 dB SPL I)
- > Enforce dialogue loudness uniformity between programmes, broadcast channels.
(Please, no commercials at 100 dB SPL II)

Dialogue Level Uniformity

- Dialogue level (dialnorm) is explicitly coded into the AC-3 bit stream
- The audio reproduction system should use this value to adjust the reproduction volume
- The listener should adjust the volume control for the desired level of dialogue
- All programs will then reproduce with dialogue at this level
- The volume control may be calibrated in SPL

Dialogue Level



Dynamic Range Compression

- Compression control words are placed into the AC-3 bit stream
- Compression characteristics controlled by program provider
- Decoder uses control words (by default), and reproduces compressed audio
- Decoder may (at option of listener) restrict or eliminate the use of compression control words resulting in the reproduction of more, or all, of the original dynamic range
- Dialogue level is not altered; louder sounds are brought down in level, quieter sounds are brought up in level

Level Compression

