Dolby Tone / Dolby Noise Definitions

The Dolby Tone is generated by a constant amplitude oscillator which is periodically frequency-modulated upwards with a 10% frequency change. The modulation occurs for a period in the low tens of milliseconds, which the ear interprets not as frequency modulation, but more as amplitude modulation. However, since the amplitude is in fact constant, level-setting meters maintain a constant indication (regardless of their time constants). The resulting periodic chirp-like sound is highly characteristic.

Dolby Tone, A-Type Noise Reduction
850 Hz tone with a single 30 ms modulation pulse (10% upwards in frequency) every 750 ms.

Dolby Tone, B-Type Noise Reduction
400 Hz tone with a single 15 ms modulation pulse (10% upwards in frequency) every 500 ms.

Dolby Tone, C-Type Noise Reduction
400 Hz tone with a single 5.5 ms modulation pulse (10% upwards in frequency) every 1.1 sec.
Note: Prior to Sept, 1982 the C-Type signal was a "warble" tone which used a 30 ms double pulse every 500 ms. Users found this annoying over long periods of time.

Dolby Tone, S-Type Noise Reduction
400 Hz tone with a pair of 15 ms modulation pulses (10% upwards in frequency separated by 100 ms) every 500 ms.

Dolby Noise, Dolby SR Spectral Recording
Pink noise interrupted every two seconds by a 20 ms gap of silence. These periodic interruptions (sometimes called "nicks") serve to positively distinguish Dolby Noise from other pink noise.

Bill Wray 24 February, 2009

Basic Dolby Level Standardization Requirements
(From the Dolby Model 365 two-channel noise reduction processor User's manual, 1985)

1) Introduction

Correct operation of the Dolby A-type Noise Reduction System is dependent on only one basic requirement - that the signal voltage in the playback processor should be the same (within 2 dB) as that in the recording processor. In other words, the recording system should have an effective overall record-playback gain of unity. However, the requirement for signal interchangeability imposes a further requirement- that the signal levels in the noise reduction system should be related to the levels of internationally recognized standards, such as magnetic test tapes (of which the most widely used are the Ampex NAB and DIN tapes).

In order to correlate the various voltage levels and flux levels used in the complete recording or transmission chain, the concept of "Dolby Level" is employed. Dolby Level bears a fixed amplitude relationship to the noise reduction compression and expansion parameters. In 360 Series units, this level correlation is achieved in practice by a meter with a Dolby Level mark and by a special built-in Dolby Tone oscillator which generates a signal at Dolby Level. For maximum effectiveness, the Dolby Tone has been designed to be easily recognizable in order to avoid possible confusion with the multiplicity of tone signals at present in use for equalization or testing purposes. Its level has been chosen to be readily measurable on normal program level meters in studios or broadcast stations, as well as on the meters of Dolby Model 360 Series units (on Dolby A301 units Dolby Level corresponds to the NAB meter mark). Since Dolby Level bears a fixed relationship to the noise reduction transfer curves, it can be further linked to the recording or transmission system parameters - i.e. line levels, flux levels, etc.

2) Magnetic Tape Recording

Dolby Level is linked to the magnetic flux level on the tape and was originally defined as 185 nWb/m (this corresponds to Ampex operating level which is approximately 4.8 dB below the I.E.C. reference level of 320 nWb/m). As tape types have improved, operational levels have increased, and 185 nWb/m may not he appropriate. If you use VU meters then use a Dolby Level equal to the flux level which corresponds to 0 VU. If you use peak reading meters then use a Dolby Level equal to the flux level corresponding to 5dB below your 100% level. For other types of magnetic media Dolby Level is defined as follows:

Magnetic film: 185nWb/m
Audio on video tape (Dolby B- and C-type format): 100 nWb/m (EBU/SMPTE reference level) Audio on C-format 1" video tape: 100 nWb/m (or equivalent line level)

3) Transmission Applications

Dolby Level is linked to the transmission level by the following relationships:

3a) If VU meters are used, Dolby Level corresponds to 0 VU on a steady-state basis.

3b) If fast risetime peak program meters are used, Dolby Level corresponds to a level of 4 dB below the nominal 100% or peak operating level on a steady-state basis (i.e. PPM 5 for UK peak meters, +4 on the EBU meter scale, or -4 on light-beam instruments).

4) Optical Sound Tracks: Dolby Level is defined as 6dB below clash (clipping) level, or 50% of full track width modulation.

5) Other Systems: Dolby Level can be defined by reference to the overload properties of the transmission system following the guidelines provided by the above definitions.

6) Adjustment of Input and Output Levels

A generalized description is given here to illustrate the part played by Dolby Level calibration.

Decode or playback units are calibrated first. A tone, from a test tape or oscillator, at either 0 VU (or Ampex Operating Level-Dolby Level) or DIN (PEAK) level, is fed into the Dolby unit and the input level potentiometer is adjusted to give an appropriate reading on the front-panel meter (i.e. Dolby Level or PEAK REF). The output level potentiometer is then adjusted to give unity gain through the unit.

Following correct calibration of the decoder, the encoder or record processor is set up. The record gain controls on the recorder or the line sending controls on the line amplifier are adjusted to suit the usual line levels. The Dolby Tone button is pressed, and the output level control on the Dolby unit is adjusted such that the recorder or received tone, as indicated by the previously calibrated decoder unit, is at the Dolby Level mark. The input potentiometer of the encoder unit is then adjusted to suit the incoming signal level.

After this calibration is completed, the Dolby encoder and decoder units, together with the recorder or transmission line coupling them, should be treated as a fixed, unity-gain system. The decoded output is at studio or line level; for encoding, studio or line level should be fed in.

In operation, do not compensate for different types of program material (e.g. piano) or different types of tape (e.g. high-output) by altering any of the previously adjusted record and playback gain controls in the chain. Set the level actually recorded on the tape or sent to the line by adjusting the level of the program source (mixer output). The calibration procedure ensures that the internal characteristics of the Dolby units are directly related to the transmission or recording parameters (e.g. tape flux density), and altering the gain settings to suit program material would destroy this relationship. These precautions are essential for tape and transmission standardization. To assist in maintaining standardization in tape

exchanges and inter-studio transmissions, always record or send a section of Dolby Tone at the beginning of each program using the internal Dolby Tone oscillator.

It should be emphasized that the requirement for level standardization in using the Dolby system in no sense puts a constraint on the actual program levels used. The program levels themselves should be the same as those used in the absence of the Dolby system. However, with the Dolby system in place, it may be advantageous to devote some of the increase in usable dynamic range to a reduction of distortion produced by the recording or transmission channel. A reduction of program level would then be called for.

7) Dolby SR
(From The Cat. No. 280 Dolby SR module manual, 1986)

Recording Levels for Dolby SR

Dolby Level can be established anywhere in the 100 nWb/m through 500 nWb/m region, and the Dolby SR system will give good results in all practical recording situations. Because of the overload characteristics associated with modern recording tapes however, it is recommended that Dolby Level be established in the 185 nWb/m or 200 nWb/m region in order to achieve the very highest measured signal-to-noise ratio performance.

The Dolby SR process is capable of giving magnetic recording the capacity for extraordinarily high dynamic range, in some cases as high as 100 dB for 15 IPS 1/4 inch tape.

It has become common practice for many U.S. studios to use a reference flux level of 250, 261, or 320 nWb/m, any of which can be established as a reference level for Dolby SR with good results. Some European studios however, have established an alignment tone that is closely related to "peak recording level" and can be as high as 1000 nWb/m, a few dB below tape saturation. If such a high flux level is set to equal Dolby Level in the Dolby SR unit, much of the headroom of the Cat. No. 280 will go unused and the noise floor will be influenced by that of the Dolby SR processing electronics; the full effect of the Dolby SR process will not be obtained. In order to get the maximum measured performance from Dolby SR when using such a high flux level reference tape, it is necessary to alter the alignment procedure.

Dolby Noise is an alignment signal derived from internally generated pink noise. The pink noise is generated at an accurate level with respect to the Cat. No. 280's internal signal levels and then interrupted every two seconds by a 20 ms gap of silence. These periodic interruptions (sometimes called "nicks") serve to positively distinguish Dolby Noise from other pink noise. These interruptions also provide the synchronization signal for the Auto Compare circuit used during playback.