SMPTE STANDARD

ANSI/SMPTE 18M-1991
Revision and Redesignation of ANSI V98.18M-1983

for Television Analog Recording — 1-in Type C — Basic System and Transport Geometry Parameters

1 Scope

This standard specifies the general video record system, video pole tip locations, scanner parameters, scanner-guide locations, tape tension, and test conditions for 1-in type C helical-scan television analog recorders operating on the 525/60 monochrome or NTSC color systems.

2 General specifications

Tests and measurements made on the recorder to check the requirements of this standard shall be made under the following atmospheric conditions:

Temperature for drum diameter	20°C ± 1°C
Temperature for other tests	20°C ± 1°C
Relative humidity	(50 ± 2)%
Barometric pressure	86 kPa to 106 kPa
Conditioning before testing	24 h

3 Video and sync record system

3.1 Exactly one field of video shall be recorded during each scanner revolution. The record shall be divided into two parts, video and sync.

3.2 The video record shall contain all active picture lines and sufficient vertical sync information for playback synchronization. Information not contained in the video record is defined as the vertical-interval dropout. (See ANSI/SMPTE 19M-1991.)

3.3 The sync record shall contain a number of horizontal TV lines during the vertical interval including those of the vertical-interval dropout and sufficient overlap of information for playback switching. (See ANSI/SMPTE 19M-1991.)

3.4 Recording of the sync record shall be optional; however, no other information shall be recorded in the allotted tape area.

4 Scanner pole tips

4.1 There shall be six circumferential pole tip locations as shown in figure 1, top-view. When an operational pole tip is not required, a suitable nonfunctional tip shall be placed in the same location.

4.2 Each tip projection shall be 0.06 mm ± 0.03 mm, measured from the outer surface of the upper drum to the end of the pole tip.

4.3 The axial distance between each video head pole tip and its associated sync head pole tip shall be as shown in figure 1, side view.

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Approved August 6, 1991

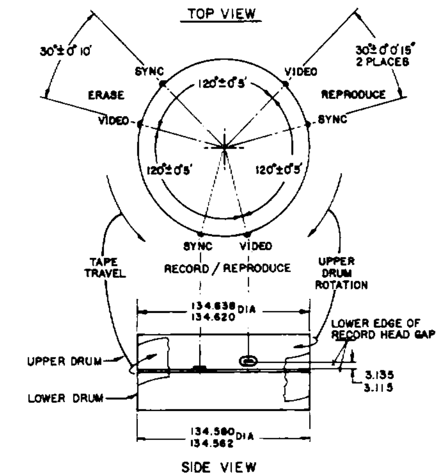

Figure 1 – Pole tip locations and drum dimensions

5 Scanner guides

5.1 Location of the tape entrance and exit guides shall provide a tape wrap angle such that the video record vertical-interval dropout is 10.00 horizontal lines ± 0.25 horizontal lines due to loss of head-to-tape contact, with no electronic switching of the recording signal. Start and end of the vertical-interval dropout shall be measured at the half-amplitude points of the RF envelope.

5.2 The helix angle formed by the scanner and all associated tape guides shall be 2°35'29"± 2".

6 Drum diameter and tape tension

Effective drum diameter, tape tension, helix angle, and tape speed completely determine the video record track angle. Different methods of design and/or minor variations in drum diameter and tape tension will produce equivalent recordings for interchange purposes. Values and operating conditions specified in this standard will produce the reference value of track angle. (See ANSI/SMPTE 19M-1991.)

6.1 The actual upper drum diameter shall be 134.620 mm + 0.018 mm − 0.000 mm.

6.2 The actual lower drum diameter shall be 134.580 mm + 0.000 mm − 0.018 mm.

6.3 The upper drum section shall rotate in synchronism with the video tips.

6.4 The center span tape tension shall be 1.7 N ± 0.3 N.

7 Definitions

The following definitions of terms ensure correct understanding of this standard:

7.1 scanner: A mechanical assembly containing a drum, rotating pole tips, and tape-guiding elements used to record and reproduce video tape recordings.

7.2 drum: A right circular cylinder around which tape is at least partially wrapped in order to form the head-to-tape interface of a video tape recording system.

7.3 upper drum: That part of the drum in a helical-scan video tape recording system which does not contact the reference edge of the tape. (See ANSI/SMPTE 19M-1991.)

7.4 lower drum: That part of the drum in a helical-scan video recording system which contacts the reference edge of the tape and usually contains tape-guiding elements. (See ANSI/SMPTE 19M-1991.)

7.5 effective drum diameter: A value of drum diameter which when used in theoretical calculations will correspond to the actual video record produced in a helical-scan video tape recording system. The effective value is equal to or greater than the actual drum diameter.

7.6 helix angle: The angle formed between the path of the rotating pole tips and the tape reference edge-guiding system on the scanner of a helical-scan video tape recording system.

7.7 track angle: The angle of the recorded video track with respect to the reference edge of the tape in a helical-scan video tape recording. (See ANSI/SMPTE 19M-1991.)

7.8 center span tension: A calculated value of tape tension at a point midway between tape entrance and exit guides of the scanner in a video tape recording system.

Annex A (informative)
Bibliography

ANSI/SMPTE 19M-1991, Television Analog Recording — 1-in Type C — Records

ANSI/SMPTE 20M-1991, Television Analog Recording — 1-in Type C Recorders and Reproducers — Longitudinal Audio Characteristics

ANSI/SMPTE 24M-1985, Video Recording — 1-in Reel Dimensions

ANSI/SMPTE 25M-1989, Video Recording — 1-in Magnetic Recording Tape

SMPTE RP 85-1991, Tracking Control Record for 1-in Type C Helical-Scan Television Tape Recording

SMPTE RP 86-1991, Video Record Parameters for 1-in Type C Helical-Scan Television Tape Recording

SMPTE STANDARD

ANSI/SMPTE 19M-1991
Revision and Redesignation of ANSI V98.19M-1983

for Television Analog Recording — 1-in Type C — Records

1 Scope

This standard specifies the dimensions and location of recorded video, audio, and tracking-control records for 1-in type C helical-scan television analog recorders operating in the 525/60 monochrome or NTSC color systems.

2 General specifications

2.1 Tests and measurements made on the tape record to check the requirements of this standard shall be made under the following conditions unless otherwise specified:

Temperature	20°C ± 1°C
Relative humidity	(50 ± 2)%
Barometric pressure	86 kPa to 106 kPa
Tape tension	1.7 N ± 0.3 N

2.2 Conditioning before recording and testing shall be as follows:

Environmental	Stabilized at measurement conditions
Tape tension	Wound on a reel at 0.5 N to 3.0 N

2.3 The reference edge of the tape for dimensions in this standard shall be the lower edge as shown in figure 1. The magnetic coating is on the side facing the observer in the figures.

3 Tape speed

The tape speed shall be 244.0 mm/s ± 0.5 mm/s.

4 Record location and dimensions

4.1 Record location and dimensions shall be as specified in figure 1 and table 1.

4.2 Dimensions P, Q, R, and θ are for reference purposes only. The parameters given in ANSI/SMPTE 18M-1991 and the tape speed completely determine these values and their tolerances. The nominal values given are based on tensioned tape; therefore, direct measurement without tension must take into account tape elasticity.

5 Video record curvature

The edge of the video record shall be contained within two parallel straight lines 0.030 mm apart.

6 Relative positions of recorded signals

6.1 Video, sync, tracking control, and audio signals with information intended to be time coincident shall be positioned as specified in figure 2 and table 1. Dimensions T, U, Y, and Z are for reference purposes only.

6.2 The start of the video record is that location on the video record which would be produced by scanner and guide locations with no electronic switching of the recording signal.

6.3 The vertical-interval dropout location with respect to a television frame is determined by the phase dimension, T, measured from the start of video to the negative-going edge of line 25 H-sync in odd-numbered fields.

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Approved August 6, 1991

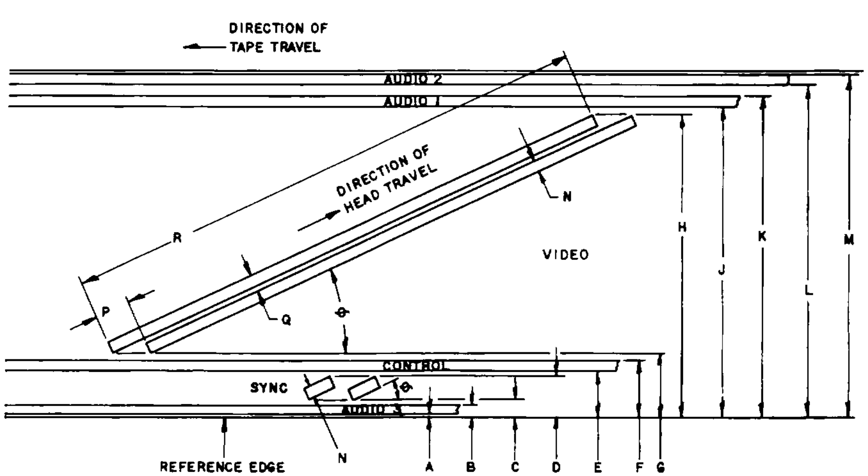

Figure 1 – Record location and dimensions

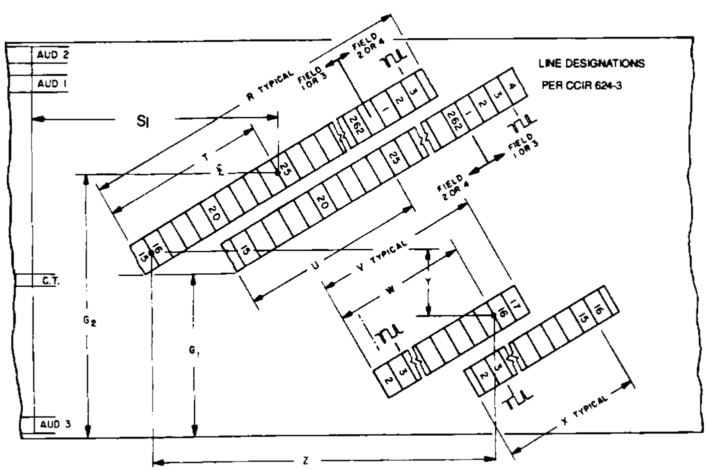

Figure 2 – Video and sync record location

Table 1

	Dimensions	Millimeters Minimum	Maximum
A*	Audio 3 lower edge	0.050	0.150
B*	Audio 3 upper edge	0.825	0.975
C	Sync track lower edge	1.385	1.445
D	Sync track upper edge	2.680	2.740
E	Control track lower edge	2.870	3.130
F	Control track upper edge	3.430	3.770
G_1	Video track lower edge	3.860	3.920
G_2	Video line 25 start	4.650	4.710
H	Video track upper edge	22.355	22.475
J*	Audio 1 lower edge	22.770	22.830
K*	Audio 1 upper edge	23.525	23.675
L*	Audio 2 lower edge	24.325	24.475
M*	Audio 2 upper edge	25.150	25.250
N	Video and sync track width	0.125	0.135
P	Video offset	4.067 ref (2.5 H)	
Q	Video track pitch	0.1823 ref	
R	Video track length	410.764 ref (252.5 H)	
S**	Control track head distance (mechanical dimension)	116.23	117.03
S_1	Control track head distance (tape footprint)	114.70	115.10
T	Vertical phase odd field	16.270 ref (10.0 H)	
U	Vertical phase even field	17.080 ref (10.5 H)	
V	Sync track length	25.620 (15.75 H)	26.420 (16.25 H)
W	Vertical phase odd sync field	22.360 (13.75 H)	23.170 (14.25 H)
X	Vertical phase even sync field	23.170 (14.25 H)	23.980 (14.75 H)
Y	Vertical head offset	1.529 ref	
Z	Horizontal head offset	35.380 ref	
θ	Track angle	2°34' ref	

*See annex A.
**Dimension S is not shown in figure 2. It is a physical transport dimension that should result in the footprint dimension S_1.

6.4 The start and end of the sync record must be produced by electronic switching of the recording signal due to geometric constraints. (See ANSI/SMPTE 18M-1991.) Phasing of the sync record electronic switching shall be as per phase dimension W in odd-numbered fields.

6.5 Even-numbered fields have a different video and sync phasing (dimensions U and X) due to the odd number of lines in a television frame.

7 Gap azimuth

7.1 The azimuth of all head gaps used to produce longitudinal track records shall be perpendicular to the direction of relative head-to-tape motion.

7.2 The azimuth of the video and sync head gaps shall be perpendicular to the direction of head motion.

Annex A (informative)
Dimensions

Dimensions A, B, J, K, L, and M have been revised to reduce audio level interchange differences. Audio head stacks produced prior to this standard may produce track records with wider tolerances.

Annex B (informative)
Bibliography

ANSI/SMPTE 18M-1991, Television Analog Recording — 1-in Type C — Basic System and Transport Geometry Parameters

CCIR Report 624-3 (MOD-F), Characteristics of Television Systems

SMPTE STANDARD

ANSI/SMPTE 20M-1991
Revision of
ANSI/SMPTE 20M-1985

for Television Analog Recording — 1-in Type C Recorders and Reproducers — Longitudinal Audio Characteristics

1 Scope

This standard specifies the frequency response and reference level of recorders and reproducers for audio and longitudinal time and control code records for 1-in type C helical-scan television analog recording.

2 Normative references

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

ANSI/SMPTE 12M-1986, Television — Time and Control Code — Video and Audio Tape for 525-Line/60-Field Systems

IEC 268-17 (1990), Standard Volume Indicators

3 Reference levels

3.1 Recording method

All recordings shall be made using the anhysteresis (bias) method.

3.2 Recording and reproducing level indicator

The audio recording and reproducing levels of a video tape recorder shall be adjusted with a standard volume indicator, as specified in IEC 268-17 (1990), or equivalent.

3.3 Recorder reference level

When a recording is made from a sinusoidal signal having a frequency of 1000 Hz such that the rms short circuit tape flux per unit track width on the record is 100 nWb/m ± 3 nWb/m of track width, the recording volume indicator shall be adjusted to deflect to its reference level (0 vu) scale mark.

3.4 Reproducer reference level

When a tape record having an rms short circuit tape flux per unit track width of 100 nWb/m and a frequency of 1000 Hz is reproduced, the reproducing volume indicator shall deflect to its reference level (0 vu) scale mark.

4. Frequency response

4.1 Recorder flux/frequency response

When a tape record is recorded from a constant voltage level applied to the input terminals of the recording system, the short circuit tape flux level on the record versus frequency, $L_\phi(f)$, shall be as given by the following equation:

$$L_\phi(f) = 10 \log_{10} \frac{1 + \left(\frac{F_l}{f}\right)^2}{1 + \left(\frac{f}{F_h}\right)^2} \text{ [dB]}$$

where L_ϕ is the relative tape flux level; f is the frequency at which the response is being computed; F_l is the low-frequency transition frequency, 50 Hz; and F_h is the high-frequency transition frequency, 10,610 Hz. (See annex A.1.)

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Approved
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4.2 Reproducer flux/frequency response

When a tape record having a short circuit tape flux level versus frequency given in 4.1 is reproduced, the output voltage level of the reproducer versus frequency shall be constant.

5 Relative polarity

5.1 Recording polarity

The recording equipment, being fed a positive waveform on pin 2 at its input, will produce a positive magnetization on the magnetic recording medium. A positive magnetization is the same direction of magnetic flux flow as that observed in a bar magnet where the flux flows out of the north and into the south pole. This flux flow is in the direction of the physical movement of the magnetic surface.

5.2 Reproduction polarity

Reproduction of a positive magnetization on the magnetic surface will provide a positive waveform on pin 2 of an XLR-3 connector at the output of the magnetic reproduction equipment. (See annex A.2.)

5.3 Record/reproduce audio head phasing

When a tape record having been produced by the same signal being recorded on the audio 1 and audio 2 tracks is reproduced by individual head gaps for audio 1 track and audio 2 track, the phase difference between the audio 1 and 2 signals shall not exceed 30° at 12 kHz. (See annex A.3.)

6 Track usage

6.1 Nonstereo audio

The primary program audio channel shall be recorded on the audio 1 track.

6.1.1 When the same signal is recorded on the audio 1 and audio 2 tracks, the tracks shall be so phased that, when reproduced with a head wide enough to sense the recorded flux on both records, they will be additive.

6.2 Stereo audio

When separate channels are used for stereo audio, the left channel shall be recorded on the audio 1 track and the right channel on the audio 2 track.

6.3 Time and control code

When used, a time and control code shall be recorded on the audio 3 track.

6.3.1 Position of the code on the video tape

6.3.1.1 The start of the address for original recording shall be as specified in ANSI/SMPTE 12M-1986.

6.3.1.2 The position of the address start point along the tape is determined by the position of the appropriate audio head gap.

6.3.2 Recorded signal

6.3.2.1 The input waveform of the recorder for original time and control code recordings shall be as specified in ANSI/SMPTE 12M-1986.

6.3.2.2 The amplitude of the recorded signal shall be such as to produce a peak-to-peak short circuit recorded flux level on the tape of at least 141 nWb/m of track width.

Annex A (informative)
Additional data

A.1 The record flux level versus frequency method given in 4.1 is equivalent to the more familiar reproduce time constant method. Transition frequencies may be calculated with the following equation:

$$F = \frac{1}{2\pi T}$$

Equivalent time constants would be:

$T_l = 3180\ \mu s$
$T_h = 15\ \mu s$

A.2 A recording channel is positive when a positive pulse produces a magnetic flux flow across the recording head gap in the direction of the tape movement. A reproducing channel is positive when a positive magnetization on the tape produces a positive pulse at the output. (See figure A.1.)

Positive polarity may be simulated in a reproducer by either of the two methods given below:

Method No. 1. Face the south pole of a magnet toward the reproduce head. Move the magnet past the head in the direction of tape movement, near enough to the head to produce an output from the reproduce channel. Observe the output of the reproduce channel on an oscilloscope. The first half cycle of the sine wave should be positive going. (See figure A.2.) Precaution should be taken to prevent magnetization of the heads or other metal surfaces.

Method No. 2. Positive polarity may be simulated in a reproducer by passing a dc pulse through a wire which is parallel to the reproduce head gap. A practical signal for measuring polarity can be generated in an induction loop by half-wave rectifying a 400-Hz sine wave. When the positive-going half-wave current flows through the conductor up through the page toward the observer (see figure A.3), this signal should produce a positive-going waveform at the output of the reproduce channel. (By classical definition, what is considered current flow is opposite to electron flow.) This signal may also be recorded and reproduced to verify the polarity of the record channel.

A.3 Record/reproduce audio head phasing may be measured by using a single, wide head to record audio 1 track and audio 2 track simultaneously. When the signal is reproduced with individual heads, the relative phase is a measure of the accuracy of alignment of the reproduce head gaps. An example would be a relative phase not to exceed 30° in the 100 Hz to 12 kHz frequency range as stated in 5.3.

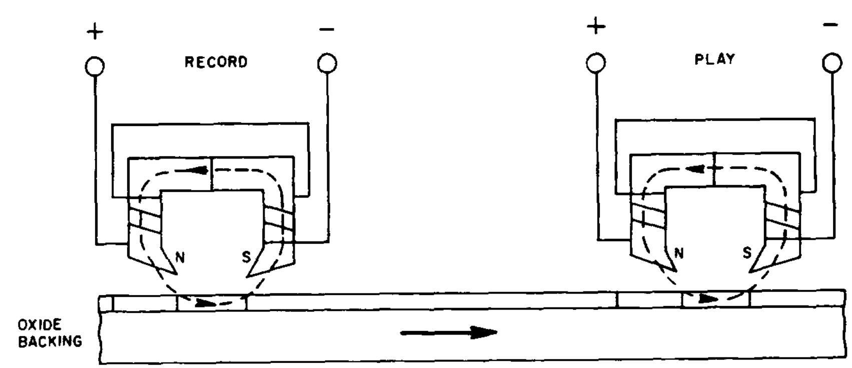

Figure A.1 – Orientation of magnetic head gaps

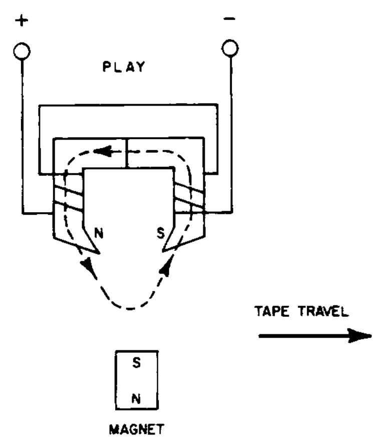

Figure A.2 – Magnetic method for determining polarity

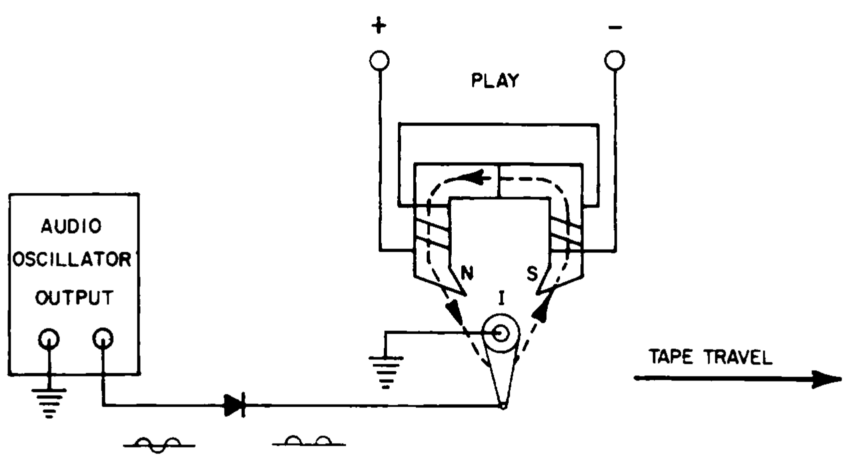

Figure A.3 – Induction loop method for determining polarity

Annex B (informative)
Bibliography

ANSI/SMPTE 18M-1991, Television Analog Recording — 1-in Type C — Basic System and Transport Geometry Parameters

ANSI/SMPTE 211M-1991
Revision and Redesignation of ANSI PH22.211M-1984

SMPTE STANDARD

for Motion-Picture Film — 16- and 35-mm Variable-Area Photographic Audio Records — Signal-to-Noise Ratio

1 Scope

This standard specifies a method for measuring the signal-to-noise ratio of 16- and 35-mm variable-area photographic audio records.

2 Definitions

2.1 biased, unmodulated audio record: A variable-area audio record with no input to the photographic audio recorder, but with noise-reduction biasing used in accordance with normal practice for the recorder being used.

2.2 fully-modulated audio record: A variable-area audio record which has an amplitude equal to the maximum amplitude permitted by the applicable standard defining the dimensions of the photographic audio records. (See annex B.)

2.3 system noise: The noise output of the reproducer itself.

2.4 unbiased, unmodulated audio record: A variable-area audio record recorded with no input to the photographic audio recorder, and with no noise-reduction biasing.

2.5 weighting network: A circuit which alters the frequency response of the measuring apparatus by a prescribed amount to provide agreement between the measured signal-to-noise ratio and the subjective impression of noisiness.

3 Test method

3.1 Test track

The test track shall consist of three sections, recorded in sequence at the same lamp-current setting and printed at the same light step.

3.1.1 Section 1 shall consist of an audio record of 1000 Hz recorded at 80% of full modulation and shall serve as the reference signal. The length of this section shall provide about 10 seconds of running time. When reproduced, this section shall have less than 5% harmonic distortion.

3.1.2 Section 2 shall be recorded with an unbiased, unmodulated audio record. The length of this section shall provide about 15 seconds of running time.

3.1.3 Section 3 shall be recorded with a biased, unmodulated audio record. The length of this section shall provide about 15 seconds of running time.

3.2 Test measurements

3.2.1 The test track described in 3.1 shall be recorded and developed under standard conditions for the system being checked. There shall be sufficient unspliced film ahead of the test track to permit stabilization of printer speed.

3.2.2 The test track shall be reproduced, and the output of the reproducer shall be measured with the required test apparatus. (See 4.1 through 4.4.) The signal level of section 1 (the reference signal) shall be measured without the weighting network, and the signal level of sections 2 and 3 shall be measured with the weighting network.

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Approved
August 6, 1991

The unbiased, unmodulated signal-to-noise ratio (A) in decibels, shall be calculated as follows:

$$A = 20 \log \frac{V_{s1}}{V_{s2}} + 2\ \text{dB}$$

where V_{s1} is the signal level of section 1 in volts and V_{s2} is the signal level of section 2 in volts.

The biased, unmodulated signal-to-noise ratio (B), in decibels, shall be calculated as follows:

$$B = 20 \log \frac{V_{s1}}{V_{s3}} + 2\ \text{dB}$$

where V_{s1} is the signal level of section 1 in volts and V_{s3} is the signal level of section 3 in volts.

3.2.3 Following the above measurements, the system noise shall be measured with the required test apparatus with the exciter lamp on, all driving and take-up motors on, and a 0.4 neutral-density filter placed at or near the film plane. The signal-to-system-noise ratio (C), in decibels, shall be calculated as follows:

$$C = 20 \log \frac{V_{s1}}{V_n} + 2\ \text{dB}$$

where V_{s1} is the signal level of section 1 in volts and V_n is the signal level of system noise in volts.

If the signal-to-system-noise ratio is not at least 10 dB greater than the unbiased, unmodulated signal-to-noise ratio or the biased, unmodulated signal-to-noise ratio, whichever is greater, the system signal-to-noise ratio measurement shall be reported with the audio track signal-to-noise ratios.

4 Test equipment

4.1 Measuring devices

Two types of measuring devices may be used:

Type CCIR/ARM consists of a weighting circuit with unity gain at 2000 Hz and an average response voltmeter. The system is described in 4.2.

Type CCIR consists of a weighting network with unity gain at 1000 Hz and a quasi-peak response voltmeter. The system is described in 4.3.

Type CCIR measurements should be made when the system to be measured contains significant amounts of impulse noise. The readings made on the two measuring systems are generally different and cannot be compared. The type of measurement used shall be stated when giving the result.

4.2 CCIR/ARM measuring apparatus

An acceptable signal-to-noise measuring apparatus is shown in figure 1.

4.2.1 Weighting network

4.2.1.1 The nominal response of the weighting network shall vary with frequency in accordance with the numerical values shown in the second column in table 1.

Figure 1 – Measuring apparatus for signal-to-noise ratio

Table 1 – Weighting curve

Frequency (Hz)	CCIR/ARM response (dB)	CCIR response (dB)	Tolerance (dB)
31.5	−35.5	−29.9	± 2.00
63.0	−29.5	−23.9	± 1.40*
100.0	−25.4	−19.8	± 1.00
200.0	−19.4	−13.8	± 0.85*
400.0	−13.4	− 7.8	± 0.70*
800.0	− 7.5	− 1.9	± 0.55*
1000.0	− 5.6	0.0	± 0.50
2000.0	0.0	+ 5.6	± 0.50*
3150.0	+ 3.4	+ 9.0	± 0.50*
4000.0	+ 4.9	+10.5	± 0.50*
5000.0	+ 6.1	+11.7	± 0.50
6300.0	+ 6.6	+12.2	0.0
7100.0	+ 6.4	+12.0	± 0.20*
8000.0	+ 5.8	+11.4	± 0.40*
9000.0	+ 4.5	+10.1	± 0.60*
10 000.0	+ 2.5	+ 8.1	± 0.80*
12 500.0	− 5.6	0.0	± 1.20*
14 000.0	−10.9	− 5.3	± 1.40*
16 000.0	−17.3	−11.7	± 1.65*
20 000.0	−27.8	−22.2	± 2.00
31 500.0	−48.3	−42.7	+ 2.80* − ∞

*This tolerance is obtained by linear interpolation on a logarithmic graph on the basis of values specified for the frequencies used to define the mask; i.e., 31.5, 100, 1000, 5000, 6300, and 20 000 Hz.

4.2.1.2 The permissible differences between the response curve of the measuring network and the nominal response of the weighting network shall be as shown in the last column of table 1.

4.2.1.3 The weighting network shall be provided with a means of bypassing or defeating itself.

4.2.2 Voltmeter

4.2.2.1 The CCIR/ARM voltmeter shall provide a voltage indication proportional to the average value of the rectified signal. It shall have sufficient sensitivity so that the noise signals will cause a meter deflection of at least one-third of full scale.

4.2.2.2 The voltmeter shall be free from excessive overswing, determined as follows: When a 1000-Hz signal is suddenly applied to the input at an amplitude which would give a steady reading of approximately two-thirds of full scale, there shall be less than 0.3 dB momentary excess reading.

4.3 CCIR measuring apparatus

An acceptable signal-to-noise measuring apparatus is shown in figure 1.

4.3.1 Weighting network

4.3.1.1 The nominal response of the CCIR weighting network shall vary with frequency in accordance with the numerical values shown in the third column of table 1.

4.3.1.2 The permissible differences between the response curve of the measuring networks and the nominal response of the weighting network shall be as shown in the last column of table 1.

4.3.1.3 The weighting network shall be provided with a means of bypassing or defeating itself.

4.3.2 Voltmeter

The CCIR voltmeter shall provide a voltage indication proportional to the quasi-peak value of the signal, as follows:

4.3.2.1 Meter response

The response of the meter to signal tone bursts shall be as shown in table 2. The method of measurement shall be as follows: Single bursts of 5-kHz tone are applied to the input of an amplitude such that the steady signal would give a reading of 80% of full scale. The limits of reading corresponding to each duration of tone burst are given in table 2.

The tests shall be performed both without adjustment of the attenuators with the readings being observed directly from the instrument scale, and also with the attenuators adjusted for each burst duration to maintain the reading as nearly constant at 80% of full scale as the attenuator steps permit.

Table 2 – Single tone burst response

Burst duration (ms)*	1	2	5	10	20	50	100	200
Amplitude reference steady signal reading								
(%)	17.0	26.6	40	48	52	59	68	80
(dB)	−15.4	−11.5	−8.0	−6.4	−5.7	−4.6	−3.3	−1.9
Limiting values								
Lower (%)	13.5	22.4	34	41	44	50	58	68
Limit (dB)	−17.4	−13.0	−9.3	−7.7	−7.1	−6.0	−4.7	−3.3
Upper (%)	21.4	31.6	46	55	60	68	78	92
Limit (dB)	−13.4	−10.0	−6.6	−5.2	−4.4	−3.3	−2.2	−0.7

*The rise- and fall-time of the burst envelope shall be less than 5 µs.

4.3.2.2 Response to repetitive tone bursts

The meter shall respond to repetitive tone bursts as shown in table 3. The method of measurement is as follows: A series of 5-millisecond bursts of a 5-kHz tone shall be applied to the input at an amplitude such that the steady signal would give a reading of 80% of full scale.

The limits of the reading corresponding to each repetition frequency are given in table 3. The tests shall be performed without adjustment of the attenuators but the characteristic shall be within tolerance on all ranges.

4.3.2.3 Overload characteristics

The overload capacity of the measuring set should be more than 20 dB with respect to the maximum indication of the scale at all settings of the attenuators. The term "overload capacity" refers both to the absence of clipping in linear stages and to retention of the law of any logarithmic or similar stage which may be incorporated. Overload capacity shall be measured as follows: Isolated 5-kHz tone bursts of 0.5-millisecond duration are applied to the input at an amplitude giving full-scale reading using the most sensitive range of the instrument. The amplitude of the tone bursts is decreased in steps by a total of 20 dB while the readings are observed to check that they decrease by corresponding steps within an overall tolerance of ± 1 dB. The test is repeated for each range.

4.3.2.4 Reversibility error

The difference in reading when the polarity of an asymmetric signal is reversed shall not be greater than 0.5 dB, measured as follows: Isolated 1-ms rectangular pulses are applied to the input in the unweighting mode, at an amplitude giving an indication of 80% of full scale. The polarity of the input signal is reversed and the difference in indication is noted.

Table 3 – Repetitive tone-burst response

Burst repetition frequency	(Hz)	2	10	100
Amplitude reference steady signal reading	(%)	48	77	97
	(dB)	−6.4	−2.3	−0.25
Limiting values				
Lower limit	(%)	43	72	94
	(dB)	−7.3	−2.9	−0.5
Upper limit	(%)	53	82	100
	(dB)	−5.5	−1.7	−0.0

4.3.2.5 Overswing

The reading device shall be free from excessive overswing, measured as follows: When a 1-kHz tone is suddenly applied to the input at an amplitude which would give a steady reading of 0.775 V or 0 dB, there shall be less than 0.3 dB momentary excess reading.

4.3.2.6 Calibration

The instrument shall be calibrated so that a steady input signal of 1-kHz sine wave at 0.775 V rms, having less than 1% total harmonic distortion, shall give a reading of 0.775 V or 0 dB. The scale should have a calibrated range of at least 20 dB with the indication corresponding to 0.775 V (or 0 dB) between 2 dB and 10 dB below full scale.

4.4 Test reproducer

The area of the film scanned by the test reproducer shall be as described in the applicable standard defining the dimensions of the photographic audio records. The test reproducer shall be capable of reproducing all frequencies of a multifrequency test film, as described by the applicable standard, at a uniform level plus or minus 2 dB. If the test reproducer does not meet this criterion, the frequency response of the test reproducer shall be reported along with the signal-to-noise ratios. The meter used for measuring the frequency response of the reproducer shall have no weighting network and shall have either an average response or a true rms meter response.

Annex A (informative)
Additional data

A.1 The effective reference signal level used in this standard is a fully-modulated audio record. However, in order to avoid the production of unwanted harmonic distortion and the possibility of uncorrectable overmodulation, 3.1.1 requires that the reference signal be recorded at 80% of full modulation. To bring the effective reference signal level to that of a fully-modulated audio track, 2 dB are then added to the measured signal-to-noise ratio in each of the equations in 3.2.2 and 3.2.3. If the reference signal is recorded at other than 80% of full modulation, a correction factor, computed as follows, should be added to the measured signal-to-noise ratio:

$$C = 20 \log \frac{0.8 \times W_a}{W_r}$$

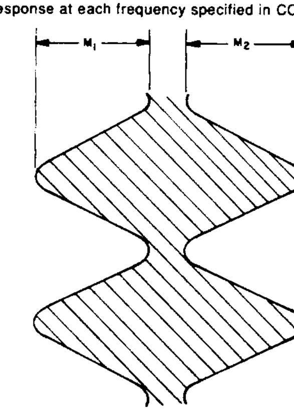
where C is the correction factor in decibels, W_a is the width of the fully-modulated audio record, and W_r is the total modulation width of the reference signal.

The total modulation width of the reference signal is the sum of the modulation amplitudes, as illustrated in figure A.1, for a bilateral variable-area audio track. The modulation width for a dual-bilateral track is calculated similarly.

A.2 It may be desirable sometimes to make a measurement of the system signal-to-noise ratio of a projector or other reproducer without making it in conjunction with a measurement of the signal-to-noise ratio of a particular audio record. In such a case, an appropriate reference signal would be that contained on the applicable signal level test film. If the reference signal is not 80% modulated, a correction factor should be applied as described in A.1.

A.3 The basic measuring method described in this standard is also applicable to 8-mm type S photographic audio tracks. However, no standards now exist describing an 8-mm type S multifrequency or signal level test film; therefore, it is not possible to measure the frequency response as required in 4.4.

A.4 The weighting curve for the CCIR/ARM meter, given in column 3 of table 1, is derived from the weighting characteristic specified in CCIR 468-2. It has been modified to have unity gain at 2000 Hz when 5.6 dB are subtracted from the response at each frequency specified in CCIR 468-2.



TOTAL MODULATION WIDTH = $M_1 + M_2$

Figure A.1 – Modulation width