PROPOSED

SMPTE ENGINEERING GUIDELINE — EG 10

Tape Transport Geometry Parameters for 19-mm Type D-1 Cassette for Component Digital Video Recording

1. *Scope*

This guideline describes three feasible examples of mechanical designs and test conditions for achieving the record dimensions specified in SMPTE 224M. The parameters are for reference purposes only.

2. *Referenced Documents*

This guideline is intended for use in conjunction with the following documents:

SMPTE 224M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Tape Record

SMPTE 225M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Magnetic Tape

SMPTE 226M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Tape Cassette

SMPTE 227M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Helical Data and Control Records

SMPTE 228M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Cue and Time and Control Code Records

CCIR Recommendation 601, Encoding Parameters of Digital Television for Studios

SMPTE EG 11, Nomenclature for 19-mm Type D-1 Cassette for Component Digital Video Recording

3. *Definitions*

Scanner: A mechanical assembly containing a drum, rotating pole tips, and tape-guiding elements used to record and reproduce digital audio and video data.

Drum: A cylindrical column around which the tape is at least partially wrapped in order to form a head-to-tape interface of a digital audio and video recording system.

Helix Angle: An angle formed between the path of the rotating pole tips and the tape reference edge-guiding system on the scanner of the helical-scan digital audio and video recording system.

Track Angle: An angle of the helical track record with respect to the reference edge of the tape.

Effective Wrap Angle: An angle at the center of the drum subtended by the start and endpoint of the track.

Total Wrap Angle: An angle at the center of the drum subtended by the lines of contact between the drum and the reference edge of the tape.

Tape Tension: Tape tension is defined by the tension after the entrance guide and before the exit guide scanner.

Center Span Tension: A calculated value of the tape tension at a point midway between the tape entrance and exit guides of the scanner in the digital audio and video recording system.

4. *General Specifications*

4.1 Dimensions are in the metric system.

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

Temperature	20°C ± 1°C
Relative Humidity	50% + 2%
Barometric Pressure	96 kPa ± 10 kPa
Conditioning of the recorder before testing	Not less than 24 hours

5. *Scanner Parameters*

5.1 The effective drum diameter, tape tension, helix angle, and tape speed taken together determine the track angle. Different methods of design and/or variations in drum diameter and tape tension can produce equivalent recordings for interchange purposes.

5.2 Three possible design examples are specified in the tables and figures.

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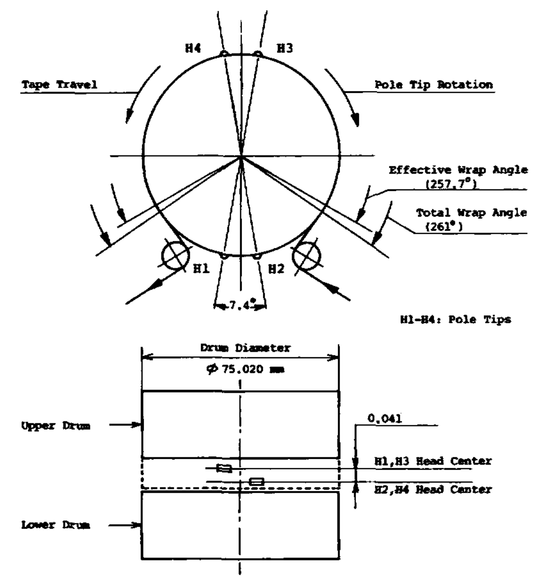

Fig. 1
Scanner Configuration for Design I

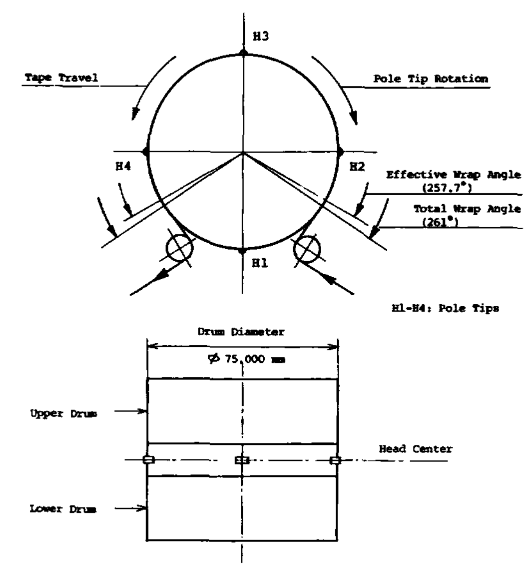

Fig. 2
Scanner Configuration for Design II

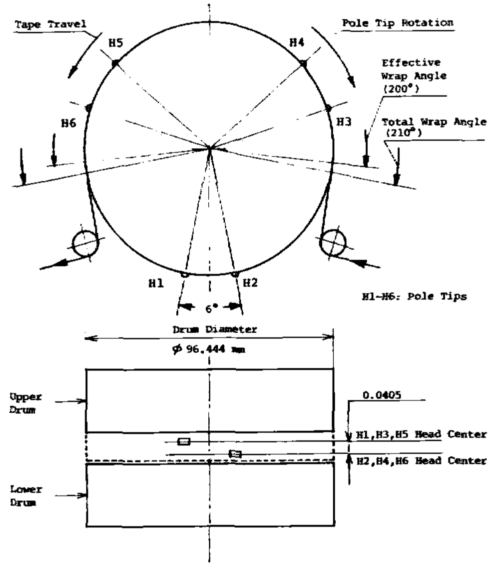

Fig. 3
Scanner Configuration for Design III

Table 1
Pole Tip Relationships for Design I, II and III

Parameters	Design I	Design II	Design III
Relevant Figures	Fig. 1	Fig. 2	Fig. 3
Minimum Number of Pole Tips	4	4	6
Angular Relationship	H1 — H2: 7.4° H3 — H4: 7.4° H1 — H3: 180° H2 — H4: 180°	H1, H2, H3, and H4 equispaced 90° ± .00833°	H1 — H2: 6.0° H3 — H4: 6.0° H5 — H6: 6.0° H1 — H3: 120.0° H3 — H5: 120.0° H5 — H1: 120.0°
Vertical Displacement (mm)	H1 — H2: 0.041 H3 — H4: 0.041	± 0.002 Max	H1 — H2: 0.0405 H3 — H4: 0.0405 H5 — H6: 0.0405
Maximum Tip Projection (μm)	45	45	60

Table 2
Scanner Design Parameters

Parameter		Design I	Design II	Design III
Scanner Rotation Speed (r.p.s)		150/1.001	150/1.001	100/1.001
Number of Tracks per rotation		4	4	6
Drum Diameter Upper (mm) Lower (mm)		 75.020 ± 0.005 75.000 ± 0.005	 75.000 ± 0.005 75.000 ± 0.005	 96.444 96.400
Tape Tension	IN	NA	0.6 ± 0.005	NA
	OUT	NA	1.0 ± 0.1	NA
Center Span Tension (N)			0.8 ± 0.2	
Helix Angle		5.4444° ± .0028°	5.4441° ± .0002°	5.4517°
Effective Wrap Angle		257.7°	257.7°	200.0°
Total Wrap Angle		261.0°	261.0°	210.0°
Scanner Circumferential Speed (m/sec)		35.3	35.3	30.3

NA = Not available at this time.

PROPOSED

SMPTE ENGINEERING GUIDELINE EG 11

Nomenclature for 19-mm Type D-1 Cassette for Component Digital Video Recording

1. *Scope*

This guideline defines the terms that are specific to component digital video tape recorder format D-1 and used in the referenced documents for this format.

2. *Referenced Documents*

This guideline is intended for use in conjunction with the following documents:

ANSI S4.40-1985, Recommended Practice for Digital Audio Engineering — Serial Transmission Format for Linearly Represented Digital Audio Data

SMPTE 224M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Tape Record

SMPTE 225M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Magnetic Tape

SMPTE 226M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Tape Cassette

SMPTE 227M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Helical Data and Control Records

SMPTE 228M, Component Digital Video Recording — 19-mm Type D-1 Cassette — Cue and Time and Control Code Records

CCIR Recommendation 601, Encoding Parameters of Digital Television for Studios

SMPTE EG 10, Tape Transport Geometry Parameters for 19-mm Type D-1 Cassette for Component Digital Video Recording

3. *General Definitions*

3.1 D-1 Format Recorder. A helical-scan digital cassette video tape recorder using 19-mm type D-1 cassettes to record and reproduce the standard digital video components specified in CCIR Recommendation 601 and four digital audio channels.

3.2 Program Area. The program area is that part of the tape on which is recorded the program digital video and digital audio signals.

3.3 Program Area Track Pattern — Video and Audio Sectors. A head which is recording during an entire scan of the program area lays down a helical track consisting of six data sectors in the sequence: video-audio-audio-audio-audio-video. Twenty such tracks contain a video recording equivalent to the period of one television frame and audio recordings corresponding to 33.37 ms duration for each of the audio channels. The recording of a television frame, however, commences at the start of a segment (qv).

4. *Track Pattern Allocation — Video and Audio Segments*

4.1 Video Segment. A video segment contains the digital video data originating from one fifth of a television field, and comprises four video sectors. These are located in four adjacent helical tracks, the upper adjacent video sectors in the first pair of tracks and the lower adjacent video sectors in the second pair of tracks.

4.2 Audio Segment. An audio segment initially contains the digital audio data originating from a 6.673 ms period of an audio channel and comprises four audio sectors, distributed among four adjacent tracks. Hence, for this time period, the four audio segments (one for each audio channel) are associated with two video segments, and are physically recorded at the end of those video segments.

5. *Electrical Signal Allocation*

5.1 Video and Audio Sector Construction. Each video sector consists of a preamble, 160 sync blocks, and a postamble. Each audio sector consists of a preamble, five sync blocks, and a postamble.

5.1.1 Preamble. A preamble consists of a runup sequence, a sync pattern, an identification pattern, and a secondary runup sequence.

5.1.1.1 Runup Sequence. A runup sequence consists of a sequential bit pattern chosen to facilitate the locking of data-extraction circuits.

5.1.1.2 Sync Pattern. A sync pattern consists of two consecutive bytes whose bit pattern is chosen to be a robust indication of the start of a sync block.

5.1.1.3 Identification Pattern. An identification pattern consists of four consecutive bytes providing a unique address of the position of a sync block within two frames of recorded data, coded to remove dc, and provide error protection.

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5.1.1.4 Secondary Runup Sequences. A secondary runup sequence is a repetition of the pattern contained in the runup sequence enabling synchronization to be maintained through to the beginning of the sync block.

5.1.2 Sync Block. A sync block consists of a sync pattern followed by an identification pattern followed by two inner code blocks.

5.1.2.1 Inner Code Block. An inner code block consists of 60 bytes of video data, audio data, or outer code check data, followed by four bytes of inner code check data.

5.1.3 Postamble. A postamble consists of a sync pattern followed by an identification pattern.

6. *Subsets of Binary Data*

Usually, for convenience in parallel digital processing, binary information is processed in groups of bits referred to in the literature as words, bytes, and words of four bits. These terms have generally understood meanings but are not unambiguously defined. For the purpose of this terminology, the following definitions are assumed.

6.1 Byte. A byte consists of eight bits of binary information. It may have an identity other than being a convenient processing unit (for example, see video data word), but generally this is not implicit.

6.2 Video Data Word. A video data word is a byte in which the eight bits represent the possible 256 quantum levels of a video sample.

6.3 Audio Data Word. An audio data word consists of 20 bits. In the most basic operating mode 16 bits represent the possible 2^{16} quantum levels of an audio sample and four bits are used for auxiliary signals. Other modes are defined in which either one, two, three, or four of the dynamic range of the audio sample quantization. For convenience, the 20-bit word is usually processed in five words of four bits.

7. *Error Protection Strategy*

Various methods are used to reduce the effect of digital errors on the objective and subjective quality of the replayed video or audio.

The appropriate combination of methods to achieve an optimum result is generally known as the error protection strategy.

7.1 Error Correction. The use of mathematically related check data recorded with the video and audio data, to predict the precise location and, hence, enable correction of digital errors.

7.2 Error Concealment. The interpolation of error-free audio or video data words to estimate the value of data words previously detected to be in error but which cannot be corrected.

7.3 Source Precoding. The mapping of video data words so that, for the most probable distribution of digital errors, there is a reduction in the peak error produced in a video sample.

8. *Error Protection — Data Organization*

Error correction for both video data and audio data is of the product block type in which each data word is included in the computation of two sets of check data known as outer code check data and inner code check data, respectively.

Additionally, the video and audio data are redistributed from their naturally occurring sequences in order to reduce the effect of burst errors.

8.1 Video Data Sector Array. For the application of product block error correction, the 18,000 video data words to be recorded in a video sector are considered as a rectangular array with a row dimension of 600 video data words and a column dimension of 30 video data words.

8.1.1 Video Outer Code Check Data — Video Outer Code Block. Video outer code check data consists of two bytes computed from a column of the video data array and regarded as being appended to that column. (In practice, the video outer code check data is distributed within the column.) The resulting 32 bytes are known as a video outer code block.

8.1.2 Video Inner Code Check Data — Video Inner Code Block. Video inner code check data consists of four bytes computed from a 60-byte subset of a row of the video array (or a row of the video outer code check data) and appended to that subset. The resulting 64 bytes are known as a video inner code block.

8.1.3 Video Product Block. The array defined by 32 video inner code blocks or the corresponding 64 video outer code blocks is known as a video product block. There are 10 such video product blocks in a video sector.

8.2 Audio Data Array. An audio sector contains either odd audio data words or even audio data words. For the application of product block error correction, the 168 words of 20 bits each to be recorded in an audio sector are considered as a rectangular array with a row dimension of 120 words of four bits and a column dimension of seven words of four bits.

8.2.1 Audio Outer Code Check Data — Audio Outer Code Block. Audio outer code check data consists of three words of four bits computed from the seven words of four bits column of the audio data array and regarded as being appended to that column. (In practice the audio outer code check data is distributed within the column.) The resulting 10 words of four bits are known as an audio outer code block.

8.2.2 Audio Inner Code Check Data — Audio Inner Code Block. Audio outer code check data consists of four bytes computed from a row of the audio array (or the appended audio outer code check data). The resulting 64 bytes are known as an audio inner code block.

8.2.3 Audio Product Block. The array defined by the 10 audio inner code blocks or by the corresponding 64 audio outer code blocks, is known as an audio product block. There is one audio product block in an audio sector.

8.3 Video and Audio Data Redistribution

8.3.1 Interleaving. The systematic reordering of data so that originally adjacent bytes of video or words of four bits of audio are separated, thus reducing the effect of burst errors on the error correcting capability. The separation in bytes and words of four bits respectively is known as the interleave distance.

8.3.2 Shuffling. The systematic reordering of video or audio data words to increase the probability that uncorrectable samples are surrounded by error-free data words, for the application of error concealment.

9. *Other Electrical Definitions*

9.1 Channel Coding. The process by which binary information obtained from the digital logic circuits, used in the processing of video and audio data, is converted to a waveform suitable for recording onto a magnetic medium.

9.2 Randomization. The reduction of correlation in a serial bit sequence so that it statistically approximates a random sequence.

9.3 Scrambling. Alternate term for randomization.

9.4 Mapping. The recoding of data, by computation or look-up table, so that there is a defined one-to-one relationship between each original code word and the derived code word.

10. *Mechanical Terms*

10.1 Basic Dimension. A basic dimension is a fundamental dimension to which no tolerance is applicable.

10.2 Derived Dimension. A derived dimension is obtained from other fundamental dimensions by computation and is given for informational purposes only.

10.3 Reference Dimension. A dimension usually without tolerance, used for informational purposes. It may be a dimension resulting from other values.

11. *Editing Definitions*

11.1 Edit Gap. The space between adjacent sectors, to which edit transitions must be confined, between the end of the trailing sector postamble and the leading sector preamble.

11.2 Cue Track. The longitudinal track reserved for the recording of audio frequency signals which are to be used for editing reference purposes.

Cinematography — Splices for use on 70 mm, 65 mm, 35 mm and 16 mm motion-picture films — Dimensions and locations

1 Scope and field of application

1.1 This International Standard specifies the dimensions and locations of transverse cemented or welded overlap splices and butt splices on 70 mm, 65 mm, 35 mm and 16 mm motion-picture films and prints with magnetic or photographic sound records.

1.2 The following types are specified:

Type 1 — Laboratory type, overlap splice intended for negatives and intermediate films, perforated short pitch.

Type 2 — Projection type, overlap splice intended for prints with non-anamorphic type picture.

Type 3 — Projection type, overlap splice intended for prints with anamorphic type picture.

Type 4 — Projection type, overlap splice made with transparent adhesive tape and intended for prints.

Type 5 — Projection type specialized uses, butt splice made with transparent tape and intended for prints.