

# PROPOSED SMPTE RECOMMENDED PRACTICE

RP 184  
Revision of RP 184-1995

## Specification of Jitter in Bit-Serial Digital Systems

Page 1 of 7 pages

### 1 Scope

This practice describes techniques for specifying jitter in self-clocking, bit-serial digital systems. It is applicable to sources, receivers, and regenerators. It is specifically intended for, but not limited to, ANSI/SMPTE 259M serial systems. Methods for measuring these specifications are found in SMPTE RP 192.

### 2 Normative references

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

ANSI/SMPTE 259M-1993, Television — 10-Bit 4:2:2 Component and 4 $f_{sc}$  NTSC Composite Digital Signals — Serial Digital Interface

SMPTE RP 192, Jitter Measurement Procedures in Bit-Serial Digital Interfaces

### 3 Definitions

**3.1 alignment jitter:** The variation in position of a signal's transitions relative to those of a clock extracted from that signal. The bandwidth of the clock extraction process determines the low-frequency limit for alignment jitter.

**3.2 input jitter tolerance:** Peak-to-peak amplitude of sinusoidal jitter that, when applied to an equipment input, causes a specified degradation of error performance.

**3.3 intrinsic jitter:** Jitter at an equipment output in the absence of input jitter.

**3.4 jitter:** The variation of a digital signal's transitions from their ideal positions in time.

**3.5 jitter transfer:** Jitter on the output of equipment resulting from applied input jitter.

**3.6 jitter transfer function:** Ratio of the output jitter to the applied input jitter as a function of frequency.

**3.7 output jitter:** Jitter at the output of equipment that is embedded in a system or network. It consists of intrinsic jitter and the jitter transfer of jitter at the equipment input.

**3.8 timing jitter:** The variation in position of a signal's transitions occurring at a rate greater than a specified frequency, typically 10 Hz or less. Variations occurring below this specified frequency are termed wander and are not addressed by this practice.

**3.9 unit interval (UI):** Abbreviated UI, it is the period of one clock cycle. It corresponds to the nominal minimum time between transitions of the serial signal.

### 4 Jitter specifications

Equipment jitter specifications fall into three categories: input jitter tolerance, jitter transfer, and intrinsic jitter. A fourth specification, output jitter, is a network specification and may be used to specify jitter limits at equipment interfaces.

RP 184

#### 4.1 Input jitter tolerance

Input jitter tolerance is the peak-to-peak amplitude of sinusoidal jitter that, when applied to an equipment input, causes a specified degradation of error performance. Input jitter tolerance is applicable to most serial inputs.

**4.1.1** Input jitter tolerance requirements are specified with a jitter template that covers a specified sinusoidal amplitude/frequency region (see figure 1). This template represents the minimum amount of jitter that the equipment must accept without causing the specified degradation of error performance. Equipment meeting a jitter tolerance requirement must have an actual jitter tolerance *greater* than the requirement (see figure 2).

**4.1.2** Input jitter tolerance requirements are specified with the parameters given in table 1.

**4.1.2.1** Frequency band  $f_1$  to  $f_2$  forms the low-frequency jitter tolerance bandpass. At least A1 UI of peak-to-peak sinusoidal jitter shall be tolerated over this bandpass without exceeding the specified error criterion.

**4.1.2.2** Frequency band  $f_3$  to  $f_4$  forms the high-frequency jitter tolerance bandpass. At least A2 UI of peak-to-peak sinusoidal jitter shall be tolerated over this bandpass without exceeding the specified error criterion.

**4.1.2.3** A1 and A2 shall be specified in UI.

**4.1.2.4** The slope of the jitter tolerance requirement between  $f_2$  and  $f_3$  shall be 20 dB/decade. Frequencies  $f_2$  and  $f_3$  are related as follows:  $F_2 = f_3/(A1/A2)$ .

**4.1.2.5** The criterion for reaching the onset of errors shall be specified. Either a BER limit or a maximum number of errored seconds over a specified measurement interval should be used.

**4.1.2.6** The test signal used for the measurement (to which sinusoidal jitter is added) shall be specified.

**4.1.3** Numerical input jitter tolerance values are provided in the appropriate SMPTE standards which reference this practice. The terminology shall comply with 4.1.2.

#### 4.2 Jitter transfer

Jitter transfer is jitter on the output of equipment resulting from applied input jitter. Jitter transfer is applicable to a device which produces a serial output from a serial input, such as a regenerator.

Jitter transfer can also occur from reference signals applied to equipment, such as analog black burst. The jitter transfer templates described below are intended for serial input to serial output jitter transfer.

**4.2.1** Jitter transfer requirements are specified with a template showing the maximum jitter gain as a function of frequency (see figure 3). Equipment meeting a jitter transfer requirement will have a jitter transfer function that lies *within* this template (see figure 4).

Table 1 — Input jitter tolerance

| Parameters      | Units | Description   |
|-----------------|-------|---|
| Data rate       | (b/s) | (Serial bit rate)   |
| $f_1$           | (Hz)  | (Low-frequency specification limit)                       |
| $f_2$           | (Hz)  | (Upper band edge for A1, low-frequency jitter tolerance)  |
| $f_3$           | (Hz)  | (Lower band edge for A2, high-frequency jitter tolerance) |
| $f_4$           | (Hz)  | (High-frequency specification limit)                      |
| A1              | (UI)  | (Low-frequency jitter tolerance, $f_1$ to $f_2$ )         |
| A2              | (UI)  | (High-frequency jitter tolerance, $f_3$ to $f_4$ )        |
| Error criterion |       | (Criterion for onset of errors)                           |
| Test signal     |       | (Test signal used for measurement)                        |