



Recommendation ITU-R BS.2032
(01/2013)

**Synchronization of digital audio
sample clock to video references**

BS Series
Broadcasting service (sound)



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Series	Title
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BS	Broadcasting service (sound)
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P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BS.2032

Synchronization of digital audio sample clock to video references

(2013)

Scope

This Recommendation provides methods for synchronizing interconnected digital audio equipment, and to address synchronization of the audio sample clocks to video reference signals.

Synchronization of digital audio signals is a necessary function for the exchange of signals between equipment. The objective of synchronization is primarily to time align sample clocks within digital audio signal sources and align them with video frames/fields.

The provisions make use of the two-channel digital audio interface standard for professional use, Recommendation ITU-R BS.647.

The ITU Radiocommunication Assembly,

considering

- a) that digital audio implementations have been widely deployed;
- b) that there would be advantages if all digital audio equipment use the same synchronizing signal;
- c) that Recommendation ITU-R BS.647 requires the use of a video synchronizing signal;
- d) that a common synchronizing signal should be used for digital video and audio equipment;
- e) that for non-TV-video related applications, a reference signal is still required for multiple source applications,

recommends

1 that synchronization of digital audio sample clock to video references defined in Annex 1 should be used;

2 that compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words “shall” or some other obligatory language such as “must” and the negative equivalents are used to express requirements.

Annex 1

The primary area of application is the digital interconnection and synchronization of digital audio equipment contained within the production and acquisition environment. A further important objective is to define a means to synchronize digital audio sample clocks to a video reference signal.

1 Modes of operation

1.1 General

Equipment should provide the ability to lock an internal sample-clock generator to a Digital Audio Reference Signal (DARS).

1.2 Synchronizing methods

Equipment should be synchronized by one of three methods.

NOTE – In some circumstances, “word clock” may be used in a manner similar to the DARS signal. Word clock is not part of this Recommendation, but is described in Appendix 2.

1.2.1 DARS referenced

Equipment is synchronized to a DARS, which ensures that all input-output equipment sample clocks are locked to the same reference frequency and within the phase tolerance specified in this Recommendation.

In situations where some 96 kHz signals are carried in the mode described in Recommendation ITU-R BS.647 as “single channel double sampling frequency mode”, it is necessary that the synchronizing reference signal has a frequency component at 48 kHz or lower, in order that two channels comprising a stereo pair shall be correctly related. Appendix 1 illustrates preferred phase relationships.

1.2.2 Video referenced

A master video reference is used to derive a DARS, locking video and audio signals at the sample-rate level and to video frame boundaries.

1.2.3 GPS referenced

A GPS receiver is used to reference a DARS, providing frequency and phase (from one-second pulses), and time-of-day sample address code in bytes 18 to 21 of channel status to support a time of day reference in locked equipment.

1.3 DARS distribution

The DARS shall be distributed in compliance with Recommendation ITU-R BS.647.

1.4 External signals

1.4.1 General

When connecting external signals to an otherwise synchronous digital audio studio or production facility, § 1.4.2 shall apply.

1.4.2 Phase correction

Where the incoming signal is identical in sample frequency but is out of phase with the DARS, Recommendation ITU-R BS.647 frame alignment shall be applied.

1.5 Video referencing

1.5.1 General

In the case of a combined video and audio environment, the source of the DARS shall be locked to the video source so that the mathematical relationships given in Table 1 are obtained precisely.

TABLE 1
Audio-video synchronization

Sample rate (kHz)	Samples per frame					
	25 Hz	30 Hz	29.97 Hz	50 Hz	60 Hz	59.94 Hz
48	1920	1600	8008/5	960	800	4004/5
96	3840	3200	16016/5	1920	1600	8008/5

1.5.2 Integer ratios

For video systems with an integer number of Recommendation ITU-R BS.647 frames in one video frame, the Recommendation ITU-R BS.647 audio can be locked synchronously to the video.

1.5.3 Non-integer ratios – 5-frame lock

For video systems with fractions of Recommendation ITU-R BS.647 frames in one video frame, Recommendation ITU-R BS.647 audio sample clocks can be locked using the video reference signal defined in Appendix 3. In this case, there is a 5-frame locking cycle.

1.5.4 Non-integer ratios – Random lock

It is common practice that the audio sample clock is synchronized on a video frame at random. While the frequency of the sample clock will be locked, the absolute phasing will not be maintained. Systems that utilize this means of locking do require buffers to ensure phasing of all equipment.

NOTE – While every effort is taken to maintain a 5-frame sequence, it is not unusual for there to be less or greater number of samples within the 5-frame sequence. These discrepancies occur when material is edited or switched.

2 Recommended practice for equipment synchronization

2.1 DARS requirements

2.1.1 DARS format

The DARS shall have the format and electrical configuration of the two-channel digital audio interface and use the same connector as given in Recommendation ITU-R BS.647. However, the basic structure of the digital audio interface format, where only the preamble is active, shall be acceptable as a digital audio synchronizing signal.