Multi-standard Analog TV Modulator

bc008

The Binary Core bc008 is a multi-standard digital implementation of the analog TV modulator. The core is compliant with the most common analog TV standard. It is highly configurable and can be easily integrated in your system.

Features

- Compatible with PAL (B, G, H, I, M, N), SECAM (B, G, H, D, K, K1, L), and NTSC (M) standards.

- 4:2:2 10 bit parallel input (D1 format - ITU-R656).

- System clock derived from video input.

- Fully configurable luminance and chrominance levels.

- Selectable video low pass filter stop bandwidth (4.5, 5.0, 6.0, 6.5 MHz).

- Selectable vestigial side band filter stop bandwidth (-0.75, -1.25 MHz).

- Selectable video group delay pre-correction (Curve A, Curve B, M system Curve, DK system Curve, Flat).

- 2-channel audio input (20 Hz to 15 kHz bandwidth), 16 bits per channel @48 kHz sampling frequency. I2S input format. Single 90 kHz bandwidth channel @200 kHz sampling frequency in also supported (BTSC standard).

- Selectable FM or AM audio modulation.

- Audio sub-carrier: selectable frequency (4.5, 5.5, 6.0, 6.5 MHz) and adjustable level.

- Selectable audio pre-emphasis filter (50 μs, 75 μs, flat).

- Selectable audio subcarrier deviation (FM mode).

- Audio mode: mono, stereo and dual sound selectable, according to IRT standard.

- 16-tap linear pre-correction filter.

- AM-AM/AM-PM non-linear pre-distortion (512 points).

- I/Q baseband or IF (with selectable modulation frequency) 16 bit parallel output.

- Output clock asynchronous with input clock.

Architecture overview

Video Signal

The bc007 modulator must be fed with a synchronous or asynchronous 10-bit parallel D1 signal. The 4:2:2 YCrCb input signal is encoded into all variations of NTSC, PAL or SECAM TV standards, according to the input signal's line number. The encoding process is fully configurable, targeting typical analog TV settings. The video signal is then processed with low-pass and vestigial side-band filters, in order to reach the desired bandwidth occupancy.

The video clock from D1 is used as a system clock until the output stage.

Audio Signal

The audio signal chain is fed with an I2S input signal. The audio input is a 2-channel 16-bit signal, sampled at 48 kHz (synchronously with video input clock). The single audio channel bandwidth is expected to be 20 Hz to 15 kHz bandwidth.

Audio signal modulation can be either FM and AM. For AM mode, a single channel 90 kHz input is also supported. Different audio carrier frequencies are selectable, according to the video standard. For FM mode, a selectable pre-emphasis filter is provided with 2 different curves (50 μs and 75 μs). The audio subcarrier deviation is selectable, allowing up to 100% FM over-deviation.

Different sound modes are available: mono, stereo or dual sound, according to IRT standard. IRT identification carriers are introduced.

Signal Processing

A fully configurable 16-tap linear pre-correction filter, for compensating in-band linear amplitude and phase/group delay characteristics introduced by analog output filters, is available.

A non-linear pe-distortion block, for compensating the non linear characteristics of the power amplifier, is as well present. The non linear pre-distortion is implemented with a 512-point AM-AM/AM-PM configurable lookup table.

The output stage can be either 16-bit parallel I-Q baseband or 16-bit parallel IF. The output clock is user-defined and can be asynchronous with respect to video input.