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SPDIF

History

Since the early 80's, a step towards digital audio has been set by the introduction of the Compact Disc player. In the beginning, those signals stayed inside the set, and were converted to analog signals before leaving the cabinet. A new trend is to keep signals into the digital domain as long as possible, because this is the only way to keep the signal quality. To make this possible different devices must be able communicate with one another within the digital domain. Several interfaces exist to perform such tasks, from which one has grown to the audio standard worldwide: IEC958 1989-03 (consumer Part) from the EBU. In Japan an equivalent EIAJ CP-340 1987-9 is standard.

Characteristics

Standard IEC958 "Digital audio interface" from EBU (European Broadcasting Union) details:

- Audio format : linear 16 bit default, up to 24 bit expandable
- Allowed sampling frequencies (Fs) of the audio:

travelling inside the computer (the normal output driver system and input amplifiers can be avoided). The downnside of this is that you need to build some electronics to make the signal from the CD-ROM drive to match what normal S/PDIF equipments expect.

Multi channel audio and S/PDIF

IEC958 was named IEC60958 at 1998. IEC60958 (The S/PDIF) can carry normal audio and IEC61937 datastreams. IEC61937 datastreams can contain multichannel sound like MPEG2, AC3 or DTS. When IEC61937 datastrams are transferred, the bits which normally carry audio samples are replaced with the databits from the datastream and the headers of the S/PDIF signal. Channel-status information contains one bit (but 1) which tells if the data in S/PDIF frame is digital audio or some other data (DTS, AC3, MPEG audio etc.). This bit will tell normal digital audio equipments that they don't try to play back this data as they were audio samples. (would sound really horrible if this happens for some reason).

The equipments which can handle both normal audio and IEC61937 just look at those header bits to determine what to do with the received data.

Cabling details

S/PDIF (IEC-958) uses 75 ohm coaxial cable and RCA connectors. 75 ohm coaxial cable is inexpensive, because it is the same cable as used in video transmission (you can buy a video cable with RCA connectors to connect you S/PDIF equipments together). Coaxial S/PDIF connections work typically at least to 10-15 meter distances with good 75 ohm coaxial cable.

AES/EBU-interface uses the well known symmetrical connections with transformer isolation and an output impedance of 110 ohm. The signal-level of this interface is reasonably higher than in the consumer version (3...10 volts). Because AES/EBU digital audio signals are transmitted at high, video-like frequencies (at around 6MHz) and should be handled very differently than standard analog audio lines. Commonly used XLR-3 microphone cables have various impedance ratings (30 ohm to 90 ohm typical) and exhibit poor digital transmission performance. The result is signal drop out and reduced cable lengths due to severe impedance mis-matching (VSWR) between AES/EBU 110 ohm equipment. AES/EBU signal transmission work for few tens of meters with a good cable.

There also an optical version of S/PDIF interface which is usually called Toslink, because uses Toslink optical components. The transmission media is 1 mm plastic fiber and the signals are trasmitted using visible light (red transmitting LED). The optical signals have exactly the same format as the electrical S/PDIF signals, they are just converted to light signals (light on/off). Because high light signal attenuation in the Toslink fiberoptic cable, the transmission distance available using this technique is less than 10 meters (with some equipments only few meters).