Title: Liaison to SMPTE <<fill in committee, working group, etc.>>

Date: 16 July 2009

Location: San Francisco, CA

Contacts: <<fill in appropriate contacts in 802.1>>

To: <<fill in recipient in SMPTE>>

From: IEEE 802.1

Dear…..,

The IEEE 802.1 Audio/Video Bridging (AVB) Task Group (TG) is standards to enable the transport of time-sensitive audio/video (A/V) applications over IEEE 802 bridged LAN s (e.g., Ethernet) with guaranteed quality of service. Initial application profiles include consumer audio/video, professional audio/video (including studio applications), industrial automation, and automotive. One of the AVB standards, IEEE 802.1AS, specifies the distribution of precise timing and synchronization over the AVB network. The requirements of IEEE 802.1AS will allow the media timing for each respective A/V application to meet its jitter, wander, and time synchronization requirements with appropriate filtering at the endpoints.

While the current AVB standards specify transport over 100 Mbit/s and 1 Gbit/s Ethernet, future versions of the standards are expected to specify transport for higher rates. As such, we would like the requirements of IEEE 802.1AS to enable the timing requirements for some of the uncompressed video signals specified by SMPTE to be met. The uncompressed video signals include the standard definition video signals specified in SMPTE 259M-2008 (i.e., sampled composite video signals at rates of approximately 143 Mbit/s and 177 Mbit/s, and sampled component video signals at rates of 270 Mbit/s and 360 Mbit/s), and high-definition signals specified in SMPTE 292M-2008 and SMPTE 424M-2006 (i.e., at rates of approximately 1.5 Gbit/s and 3 Gbit/s). We therefore need to ensure that the requirements of IEEE 802.1AS enable the respective jitter, frequency tolerance, and maximum frequency drift rate requirements for these signals to be met. We have obtained the jitter requirements for these signals from the above documents, and the frequency tolerance and maximum frequency drift rate requirements for the standard definition signals from SMPTE 318M-1999. Several of these requirements are quite stringent, and will require very narrow-bandwidth endpoint filtering to meet them. We therefore would like to confirm whether our understanding of these requirements and their applicability is correct.

SMPTE 318M-1999 specifies a maximum frequency drift rate of 0.1 Hz/s. It is our understanding that, in general, this standard applies to digital as well as analog video signals, including the signals specified in SMPTE 259M-2008. However, it is also our understanding that the maximum frequency drift rate requirement originally was specified to constrain the drift rate of the color subcarrier of the analog composite video signal; it corresponds to approximately 2.79 ppm/s for NTSC and 0.226 ppm/s for PAL. If the requirement is applied to the standard definition signals specified in SMPTE 259M-2008, it results in a very stringent requirement on peak-to-peak phase variation; for example, the 0.226 ppm/s limit

constrains the peak-to-peak phase variation over 0.25 s to approximately 0.56 ns. We therefore would like to know whether we are correct in applying the maximum frequency drift rate requirement to the signals specified in SMPTE 259M-2008, considering that this requirement was originally developed to control the frequency drift of the analog video color subcarrier. If the requirement does apply to the signals specified in SMPTE 259M-2008, can you tell us why it applies?

SMTPE 259M-2008, 292M-2008, and 424M-2006 specify both timing (i.e., wide-band) and alignment (i.e., high-band) jitter requirements for the respective signals specified in each document. The alignment jitter requirements are specified to ensure acceptable bit error performance for clock recovery, and the respective jitter measurement filter bandwidths (corner frequencies) are relatively high (i.e., 1 kHz for the standard definition signals and 100 kHz for the high-definition signals). However, the timing jitter requirements are very stringent; the measurement filter corner frequencies are 10 Hz in all cases, with a maximum peak-to-peak jitter of 0.2 UIpp for the standard definition signals, 1 UIpp for the approximately 1.5 Gbit/s high-definition signals, and 2 UIpp approximately 3 Gbit/s high-definition signals. For example, the 1 UIpp limit constrains the peak-to-peak phase variation over 0.03 s to approximately 0.67 ns. It is our understanding that timing jitter is typically constrained to prevent buffer overflow in regenerators; a regenerator, in addition to performing a clock recovery operation, buffers some data while smoothing (i.e., filtering) the timing, and it is necessary to ensure that the buffers do not overflow. Can you tell us the purpose of the timing jitter requirements in SMPTE 259M-2008, 292M-2008, and 424M-2006 (i.e., what are these requirements attempting to control) and, specifically , why the measurement filter bandwidths are as narrow as 10 Hz?

In summary, we would like to know:

a) Does the maximum frequency drift rate requirement of 0.1 Hz/s apply to the uncompressed digital video signals specified in SMPTE 259M-2008? If it does apply, why does it apply given that it was originally developed to control the frequency drift rate of the analog video color subcarrier?

b) What is the purpose of the timing jitter requirements in SMPTE 259M-2008, 292M-2008, and 424M-2006 (i.e., what are the requirements attempting to control)? Why are the measurement filter bandwidths as narrow as 10 Hz?

Thank you in advance for any information you can supply us on these topics. Any related information that you think would be useful to us will also be greatly appreciated.

Sincerely,