A Closer Look at the Digital Cable Network Interface Standard

By David Broberg, © April 30, 2001

Some of the first DTV receivers to enter the market in the United States were not able to tune the cable TV channel plan. This meant that if off-air DTV signals were carried on a cable system with the standard (cable) channel assignments, the tuner would not be able to lock in to the signals. This was a gross oversight for the designers, but how did it happen?

One theory is that since the digital cable network interface standards hadn't been completed at that time, the designers couldn't be sure what to do for cable, so they did nothing. Instead of following the portion of the cable standards and specifications that were already stable (including the cable channel-plan standard), they must have designed only according to the ATSC standards and broadcasting rules.

There should be no more excuses now that the formal process for acceptance as an open industry standard has been completed through the Society of Cable Telecommunications Engineers (SCTE) Digital Video Subcommittee as DVS/313. This standard serves as an overall guide to describe the characteristics of the signals of the digital cable television plant.

The network interface standard describes a wide range of parameters about the digital cable plant including: the physical layer; the frequency plan; the downstream and upstream communication channel characteristics; the forward application transport layer protocol; the out-of-band forward and reverse data channel protocols; audio and visual service characteristics and protocols; in-band and out-of-band service information protocols; emergency alert system protocol; closed captioning and content advisory signal protocols.

A large part of what needs to be described by the interface standard is listed in DVS/313 as references to other industry standards. The list of references shown below demonstrates the truly cooperative effort extended to make this standard complete:

Reference	**Area of Coverage**
EIA-23	Physical Interface: mechanical & electrical interface
EIA/CEA-542-A	Frequency plan and channel identification
EIA/CEA-608-B	Line 21 data services
EIA-708-B	Digital TV closed captioning
EIA/CEA-766-B	Region rating tables and content advisory descriptors
EIA/CEA-814 & DVS/208	Emergency alert messaging
ISO/IEC IS 13818	MPEG-2 Video Standards, amendments and corrigendum
ATSC A/52 & A/53	Digital audio and television standards
ATSC A/65A	Program and system information protocol
ANSI/SCTE DVS 031-2000	Digital video transmission standards for cable
SCTE DVS/053 (rev.6)	Vertical blanking extensions for ATSC digital signals
SCTE DVS/157 (rev.1)	Carriage of closed captions in digital video on cable
SCTE DVS/167 & 178	Out-of-band transport of broadband data for cable
SCTE DVS/234 (rev.2)	Service information delivered out-of-band for cable
SCTE DVS/241 (rev.1)	Video service multiplex and transport systems for cable
SCTE DVS/258 (rev.3)	Digital video system and format characteristics for cable

In many cases, DVS/313 only refers to certain applicable sections of these other standards or creates exceptions. The area where the most effort and the most original work were done on this standard was in the section on transmission characteristics. This is also the area that largely overlaps the *Joint Technical Agreement* between NCTA and CEA that was submitted to the FCC in February 2000.

Tables B through F primarily represent the transmission characteristics in DVS/313. These tables remain substantially unchanged since the original CableLabs OCI-N specification and the *Joint Technical Agreement*. The tables describe in detail the analog and digital downstream transmission characteristics; the forward and reverse channel RF transmission characteristics; the nominal relative carrier power levels and adjacent channel characteristics.

For most of these transmission characteristics, the hardest part was agreeing on a single target and tolerance that would adequately describe the range of operating characteristics practiced by existing digital cable systems. It is important to remember that this standard was not created as a green field project, rather it was meant as the documentation of existing practices.

The standard describes operating limits for many types of interference and distortions on a digital cable plant that can hinder error-free reception. Because existing systems operate at different signal levels and different distortion levels, each making selected trade-offs for optimum results, it was difficult to agree in some cases on a single level for every parameter because the interference and distortion parameters are so interdependent.

One parameter where some very minor changes were made was the specification for micro-reflections bound for dominant echo. In this case the limit for long echoes was removed and replaced by a rather detailed explanation that long echoes rarely occur in cable plants and such low-level reflections may not reliably be measured anyway.

With the latest version of the cable network interface standard published as SCTE DVS/313 (rev.5), all the details of the digital signals carried on cable systems have been fully documented. While this standard fully describes the characteristics of the signals on the plant and greatly clarifies what needs to be done to build a compatible receiver, it shouldn’t be considered the last word for building a digital cable receiver. If such a receiver is intended to work with subscription programming that is scrambled, attention will have to be made to the standards and specifications for the Point of Deployment (POD) module interface and the POD Copy Protection system standards among others.