Testing ASI for Video Transport Organizations

October 5, 2006

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Overview

Telecommunications operators have offered tariff services for delivery of Broadcast Video for many years. Analog and Serial Digital interface (SDI) broadcast are currently tarriffed services, but Asynchronous Serial Interface (ASI) has now been added to some carriers video transport offerings. Techniques used for testing ASI by Cable TV operators can be used to test ASI now being delivered over telecom networks originally networked for SDI transport.

This article discusses testing methods for certifying a circuit for ASI prior to handoff to the telecom customer and techniques for troubleshooting an in service ASI circuit.

Definitions

SDI is a broadcast grade video offering a number of bit rates. The two most common are the standard definition SDI 270 MB/sec bit rate defined by SMPTE 259M and the high definition SDI 1.485 GB/sec defined by SMPTE 292M. ASI is physical interface for transporting an MPEG 2 video transport stream. ASI is defined in the DVB A010 ASI-C and EN50083-9 specification and has a maximum data rate of 214 MB/sec (270 MB/sec total data rate). It has similar electrical characteristics as SDI with an 800 mV peak to peak (+/-10%).

Network Configuration

Typically an SDI circuit is engineered around a fiber optic link. The SDI signal is converted to a proprietary optical link for transport over the optical link and then converted back to electrical SDI signal as shown in Figure 1.

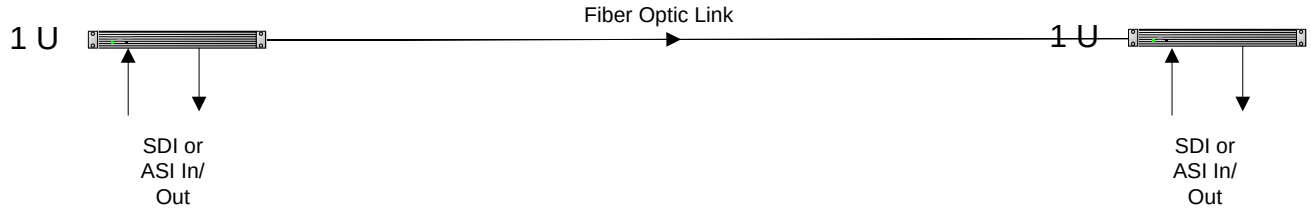


Figure 1. Electronic to Fiber Optic Conversion Diagram

Some SDI transport elements also support the carriage of ASI signals with compressed MPEG-2 transport streams. This can be verified by examining the information from the SDI transport element.

Nature of MPEG-2 transport

MPEG-2 is designed as an end to end service; however, error correction is not defined as part of the MPEG-2 Transport Stream. Instead MPEG-2 is dependent on the underlying physical layer for error correction, such as Reed-Solomon forward error correction. ASI itself does not have forward error correction, however many proprietary ASI transport systems add forward error correction. Ensuring that all of the MPEG packets are transported without error is one of the key measurements made during testing of MPEG-2.

One of the defining characteristics of a MPEG-2 Transport Stream is the synchronization of the encoder to decoder. ISO 13818 requires that the maximum Program Clock Reference (PCR) have no more than 500 nsec of inaccuracies. Additionally, it is also recommended that Overall Jitter have a maximum of 1.25 microseconds or less and typically 500 nsec of Overall Jitter is expected by the end user. Note that each time a MPEG signal is retransmitted it is possible to add PCR inaccuracies and Jitter.

Out of Service Testing

Prior to commissioning an ASI service, the circuit should be tested to ensure that MPEG-2 can be transmitted without errored or lost packets and that it is within defined timing limits.

The ASI service can be tested by inserting a pristine ASI signal identical to the signal expected to be used by the customer. Typically, a 19.39 MB/sec signal is transported by a broadcaster to deliver a high definition signal from the studio to a transmitter; however up to a 214 MB/sec MPEG transport stream can be tested. Figure 2 shows the DTS-330 with testing an ASI transport segment with an ASI test signal at location A and a second DTS-330 analyzing the resultant signal at location B. If the transport equipment supports bi-directional ASI transport, the DTS units can also insert test signals and analyze in both directions.

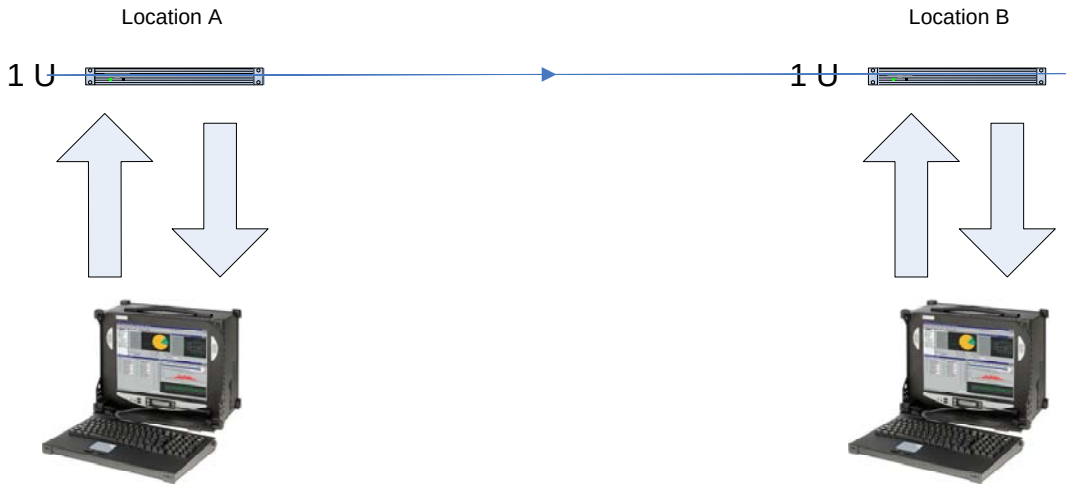


Figure 2. Commissioning Test Diagram

Figure 3 below shows a typical 19.39 MB/sec test signal. Numerous test profiles with different bit rates and programs can be created and quickly setup for testing by the technician.

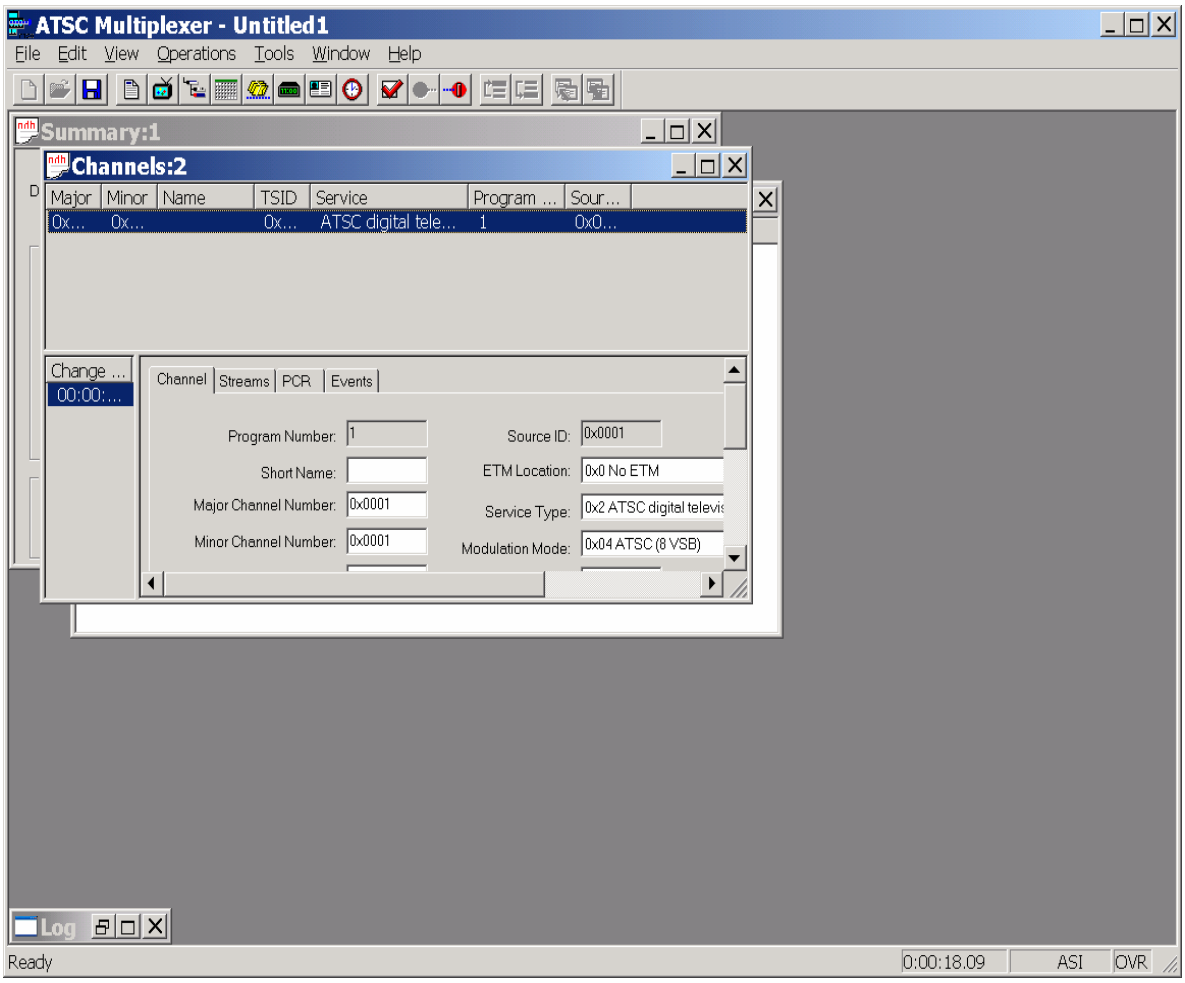


Figure 3. View of the DTS Multiplexer with a DVB signal

When the ASI signal is received by the analyzer, it is measured against the MPEG-2, DVB and ATSC standards for packet loss, bit rate, timing and protocol verification. Numerous views are available for the technician to review; however, there are several views that can be used to quickly verify the integrity of the signal.

The DTS-330 / DTS-200 Monitoring view is based on the TR 101 290 standard, a DVB standard that describes key MPEG Transport Stream parameters, such as synchronization, table format and repetition rate, packet loss (as measured by continuity counters) and timing. (See Figure 4)

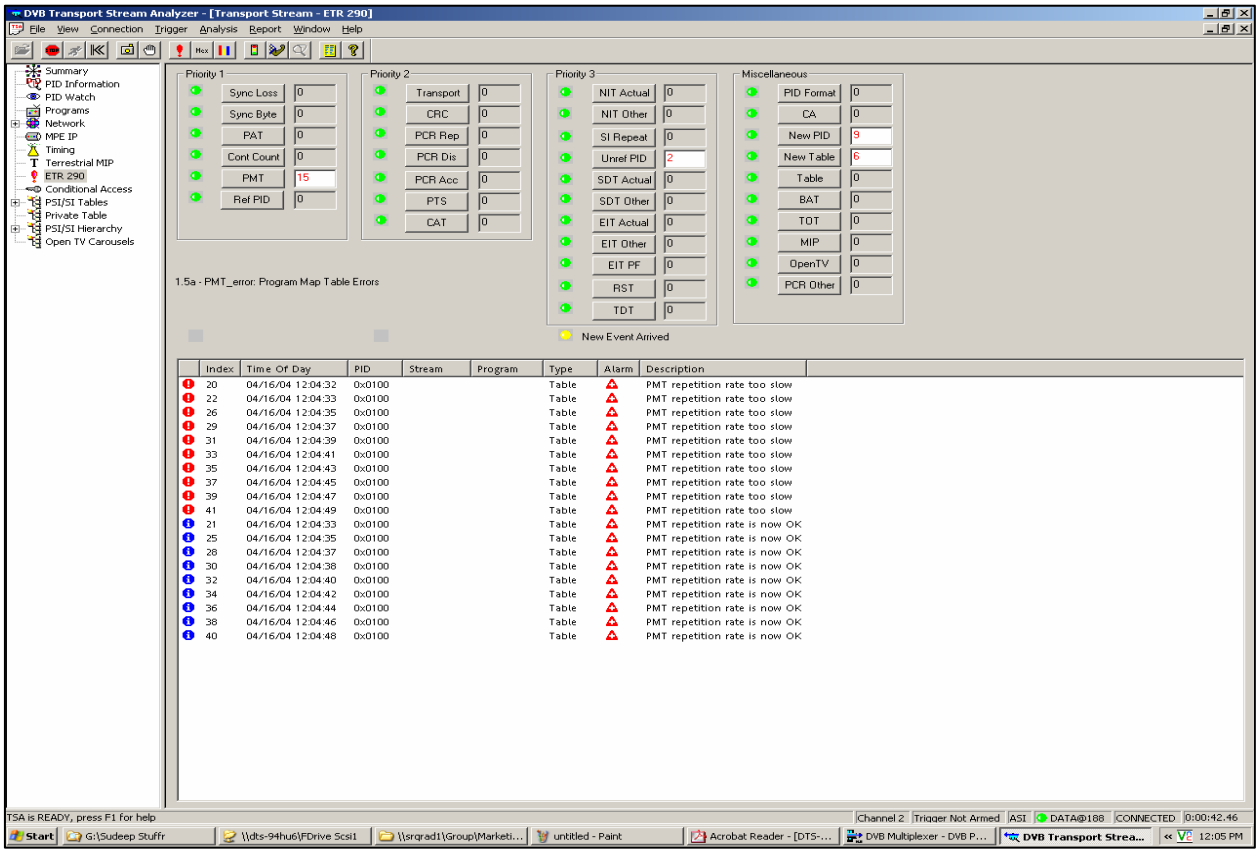
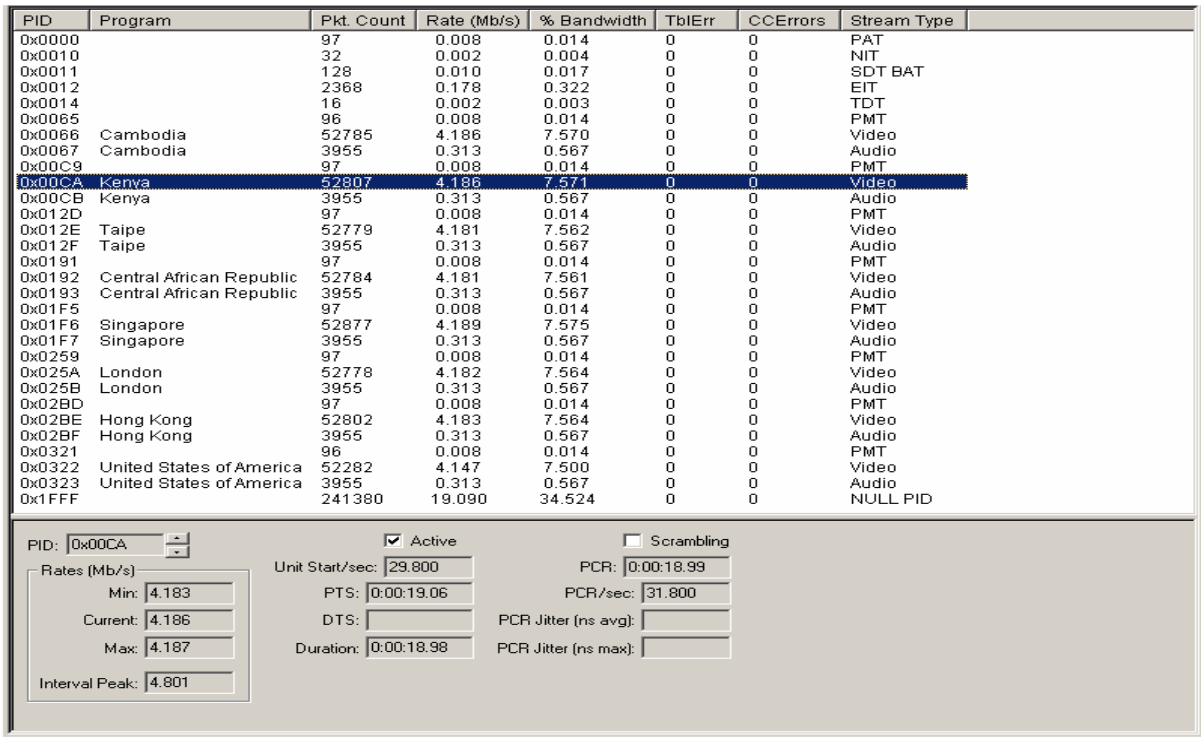


Figure 4. DTS TR 101 290 Monitoring View

Verification of the stream bit rates and Packet Identifier (PID) can be viewed using the Summary, PID information and Program Views as shown in Figure 5 below.



PID	Program	Pkt. Count	Rate (Mb/s)	% Bandwidth	TblErr	CCErrors	Stream Type
0x0000		97	0.008	0.014	0	0	PAT
0x0010		32	0.002	0.004	0	0	NIT
0x0011		128	0.010	0.017	0	0	SDT BAT
0x0012		2368	0.178	0.322	0	0	EIT
0x0014		16	0.002	0.003	0	0	TDT
0x0065		96	0.008	0.014	0	0	PMT
0x0066	Cambodia	52785	4.186	7.570	0	0	Video
0x0067	Cambodia	3955	0.313	0.567	0	0	Audio
0x00C9		97	0.008	0.014	0	0	PMT
0x00CA	Kenya	52807	4.186	7.571	0	0	Video
0x00CB	Kenya	3955	0.313	0.567	0	0	Audio
0x012D		97	0.008	0.014	0	0	PMT
0x012E	Taipe	52779	4.181	7.562	0	0	Video
0x012F	Taipe	3955	0.313	0.567	0	0	Audio
0x0191		97	0.008	0.014	0	0	PMT
0x0192	Central African Republic	52784	4.181	7.561	0	0	Video
0x0193	Central African Republic	3955	0.313	0.567	0	0	Audio
0x01F5		97	0.008	0.014	0	0	PMT
0x01F6	Singapore	52877	4.189	7.575	0	0	Video
0x01F7	Singapore	3955	0.313	0.567	0	0	Audio
0x0259		97	0.008	0.014	0	0	PMT
0x025A	London	52778	4.182	7.564	0	0	Video
0x025B	London	3955	0.313	0.567	0	0	Audio
0x02BD		97	0.008	0.014	0	0	PMT
0x02BE	Hong Kong	52802	4.183	7.564	0	0	Video
0x02BF	Hong Kong	3955	0.313	0.567	0	0	Audio
0x0321		96	0.008	0.014	0	0	PMT
0x0322	United States of America	52282	4.147	7.500	0	0	Video
0x0323	United States of America	3955	0.313	0.567	0	0	Audio
0x1FFF		241380	19.090	34.524	0	0	NULL PID

Figure 5. PID Information View

Note however, when testing ASI, this becomes a bit more complicated. To properly test ASI, one must provide an ASI source at the near end (typically an MPEG transport stream) and then analyze the signal that emerges from the far end. However, since the MPEG-2 transport stream is a standards based signal (ITU 13818-2) with pre-defined quality measurements (TR 101 290), it is also possible to verify the MPEG signal conformance at the customer hand-off at the near end as the signal enters the network, and also again when it exits the network at the far end customer site. This information can be base lined when the service is initially provisioned and saved using the reporting and capturing features of the DTS-330 or DTS-200.

Key tests to perform

For MPEG-2 Transport stream testing, TR 101 290 guidelines provide the best indication to a technician that the service is transported without error over their network. Priority 1 alarms provide key indications of synchronization, continuity errors and major table errors. Priority 2 provides transport error indicators, Cyclic Redundancy Check (CRC), errors in elementary streams and PCR timing impairments. Priority 3 provides indications of Service Information table impairments for DVB. JDSU's DTS Analyzers also provide a monitoring view that is similar in form to TR 101 290, with a Priority 3 providing PSIP table impairment information. If any impairment is indicated in the TR101 290 Monitoring view, the technician can then select the appropriate information, such as timing, channel, program, etc for more information on the impairment. Additionally, the technician may view the video signals as thumbnails, or decoded in real time as an aid to analysis. If a timing issue is identified in the TR 101 290 Monitoring View, more detailed numeric and graphical analysis can be performed by the technician in the Monitoring View.

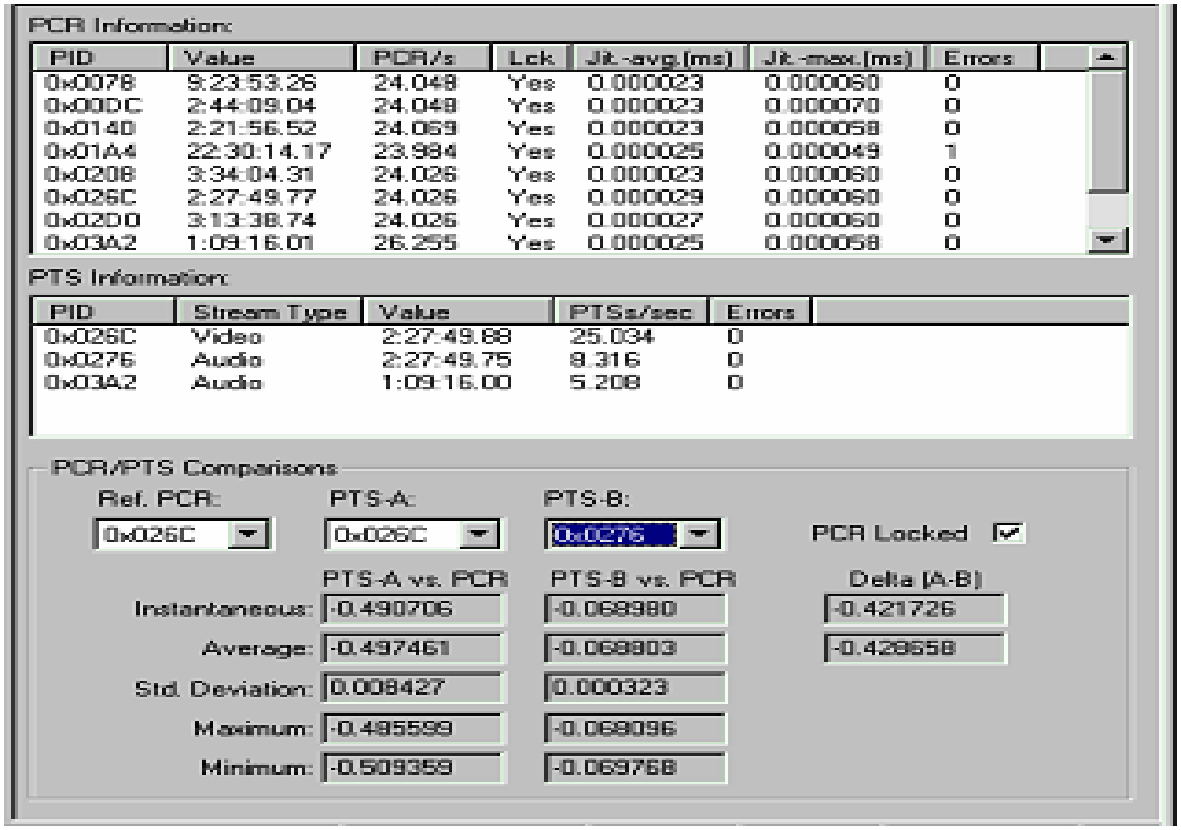


Figure 6. DTS Numeric Timing View

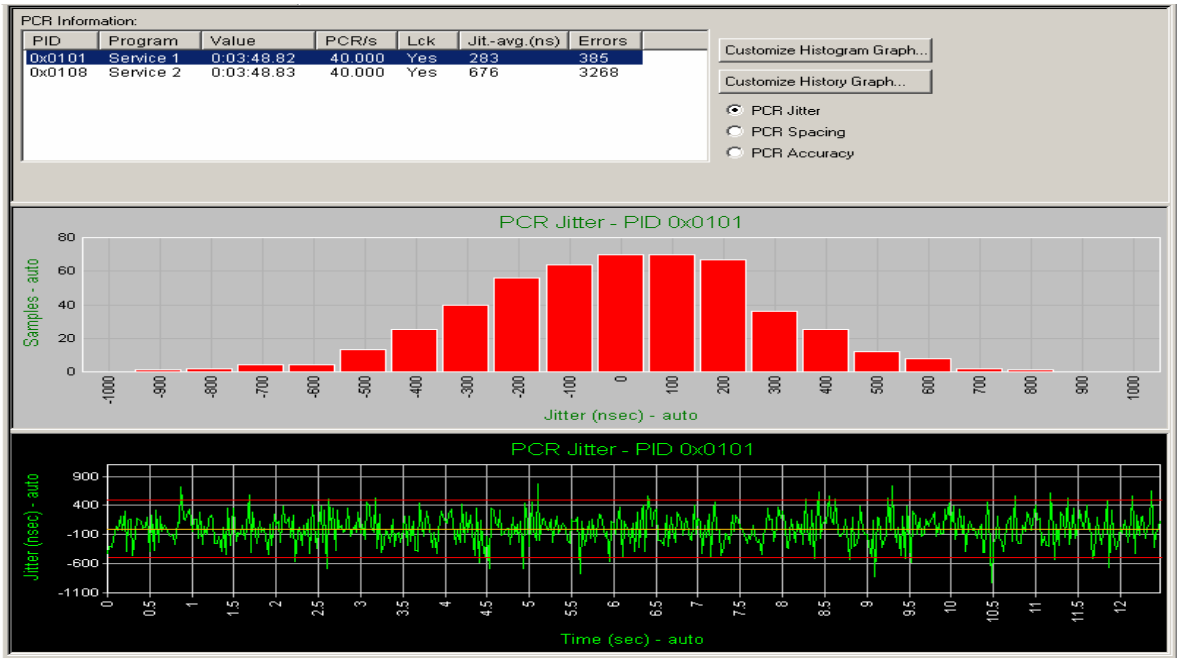


Figure 7. DTS Graphical Timing View

Documentation of the Commissioning test is essential to prove that the service was properly tested. This can be accomplished by generating a report with key parameters. Below is an example of a report generated as a text file. (See Figure 8)

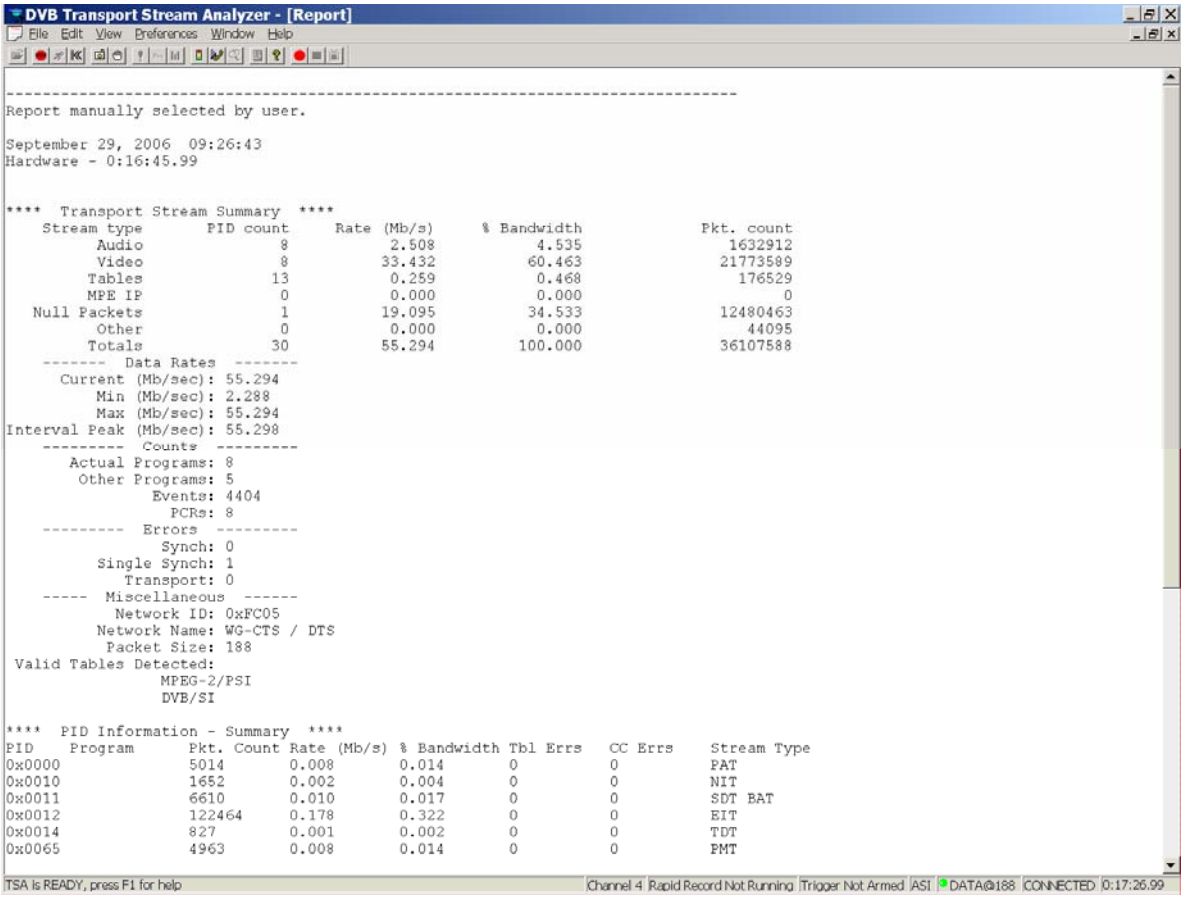


Figure 8. View of the DTS Transport Stream Analyzer Report.

In Service Testing

In Service testing is performed to help isolate the source of video errors. With customer traffic on the network, an analyzer can test the handoff at the ingress and egress of the network to help sectionalize the error to a specific network location or handoff. The same analysis used for commissioning can be used In Service testing.

Once the problem is isolated, the analyzer can record the stream for use for in troubleshooting by the equipment vendor. If the trouble is isolated to the customer side of the handoff, the recorded stream along with a report will identify the source of the video errors. (See Figure 9)

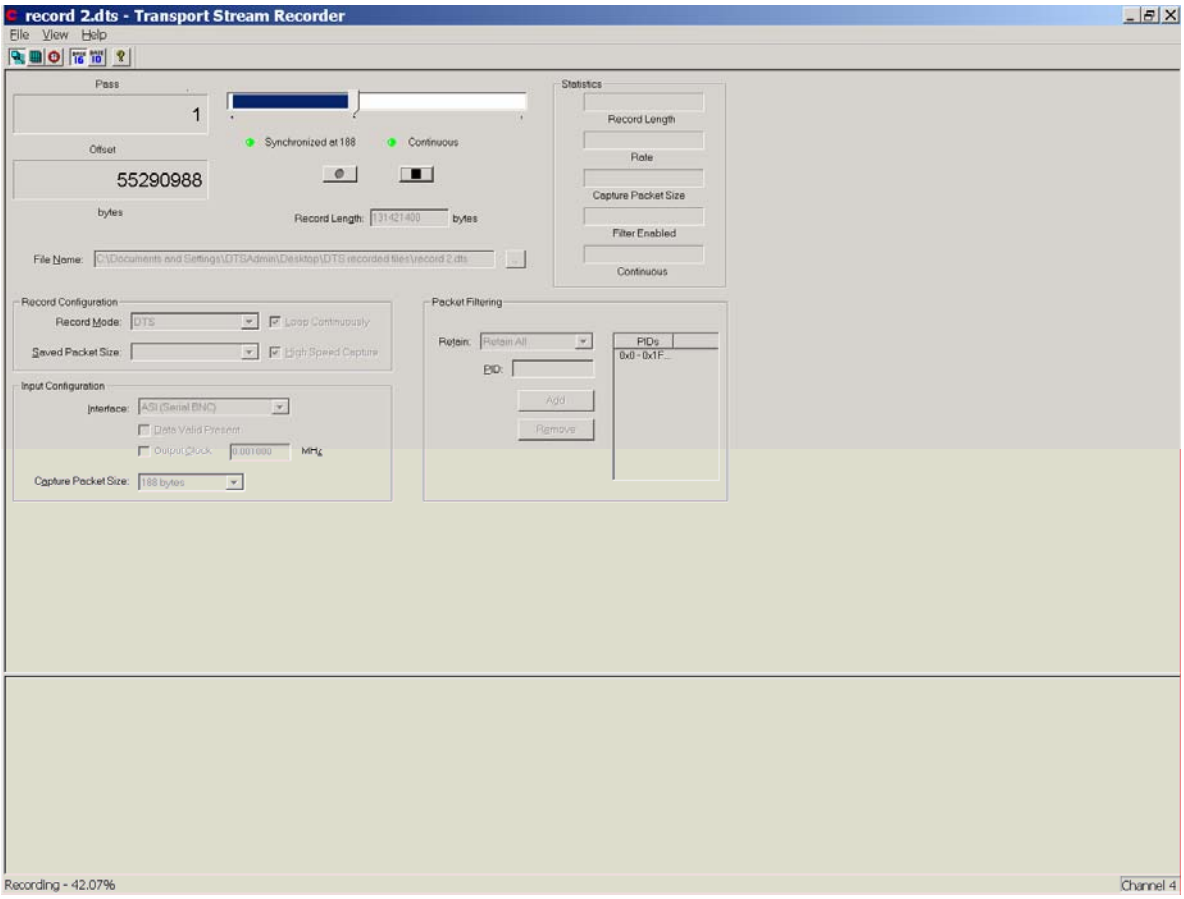


Figure 9. View of the DTS Transport Stream Recorder Feature

Summary

Testing of ASI transport networks can help prevent video errors thus reducing repeat truck rolls. Use of an MPEG Analyzer can significantly reduce the Mean Time To Repair (MTTR) and quickly identify the source of video errors. Reports, recordings and logs can quickly be created for documentation in engineering records.

More information on MPEG-2 Transport stream testing and analysis may be obtained at www.jdsu.com/test_and_measurement. Additionally, MPEG-2 posters and pocket guides may be obtained by contacting your JDSU sales representative.