

QoE IP Video Testing using VMOS on the SmartClass™ TPS



The JDSU SmartClass TPS Tester is the ideal tool for technicians who need to install Triple-Play services and, in case of services quality issues, repair them quickly

Test Challenge

When Internet Protocol television (IPTV) subscribers are unsatisfied with their perceived video service experience, they will initiate a trouble ticket with their service provider or, in worst-case scenarios, cancel service and choose another provider.

Subscribers to IP video service suggest that quality is subjective and is defined as quality of experience (QoE). The degree to which consumers are satisfied with their IP video experience depends upon QoE indicators such as service accessibility, channel change latency, color errors, freezes, gaps in playback, blurred edges, lip sync issues, and pixelization, to name a few. The viewer's perceptual QoE cannot be determined by simply measuring metrics such as packet loss and jitter. These metrics, typically referred to as quality of service (QoS) metrics, enable analysis of network performance, but translating them into user perception requires additional analysis. A metric such as the rate of packet loss rate requires more in-depth analysis, for example, to determine the distribution of loss that impacts video. The same loss rate scores very differently perceptually when errors occur simultaneously during the channel change vs. when spread out over the duration of the program. Further complexity arises with IPTV ecosystems that provide error tolerance through error recovery that already impacts QoS because of packet loss without impacting the viewer's perceived QoE until errors exceed thresholds for recovery.

Service providers and operators really need an overall combined test metric that can provide a subjective evaluation estimate of the user's perception of the video programming, such as a video Mean Opinion Score (VMOS). In-depth analysis is performed using complex algorithms to estimate how we evaluate video programming.

Addressing the Challenge with SmartClass TPS

In Video Monitor or Terminate test mode, the SmartClass Triple-Play Services (TPS) accumulates the various IP test metrics that can impact subjective QoE into a number that technicians can comprehend, the VMOS. Audio/video (A/V) MOS, Absolute MOS, and Relative MOS are provided and are most meaningful when captured as close to the set top box (STB) as possible with the portable, handheld SmartClass TPS in the Home Network and are shown in Table 1. AV MOS is the key performance indicator (KPI) for assessing the perceived combined video and audio quality, including metrics such as lip synchronization.

Table 1. VMOS results provided by SmartClass TPS

Absolute MOS	MOS estimation based upon all factors including network impairments, bit rate, codec, and encoder parameters, such as interleaving.
Relative MOS	MOS estimation based upon the factors of Absolute MOS except for the bit rate and encoder parameters.
AV MOS	Overall AV MOS score that considers both the video and associated audio stream, which is only valid when an associated audio stream is available.

VMOS groups the QoE on a scale from 1 (bad) to 5 (excellent), as shown in Table 2.

Table 2. VMOS numerical QoE ratings, ITU-R- Rec.BT-500

	Quality Scale	Impairment Scale
5	Excellent	Imperceptible
4	Good	Perceptible but not annoying
3	Fair	Slightly annoying
2	Poor	Annoying
1	Bad	Very annoying

The screen resolution with associated higher bit rate requirements, such as for a standard definition (SDTV) or high-definition television (HDTV) stream may provide different results for Absolute MOS and Relative MOS. Absolute MOS assumes better QoE for viewers watching a conveniently sized display compared to a highly compressed/small display such as a mobile device. Assessing the transmission quality of the video stream requires consideration for the Relative MOS value.

PID	Class	Relative	Absolute	AV
256	Video	4.43	4.00	4.07
257	Audio		4.75	
258	Audio		4.81	

VMOS value for a SDTV stream with insignificant packet loss and low jitter and relatively low differences between Absolute MOS and Relative MOS

1 MOS Stats MPEG2-TS Stats

MOS

PID	Class	Relative	Absolute	AV
261	Video	4.83	3.73	0.00

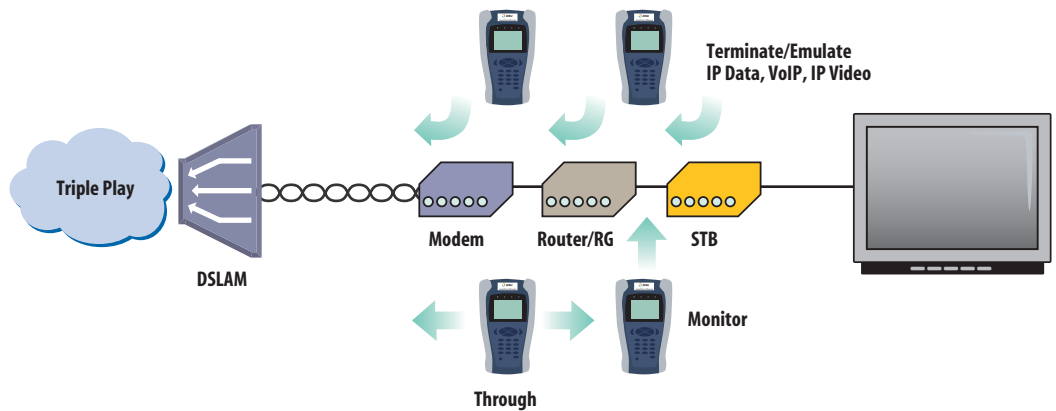
VMOS value for an SDTV stream with insignificant packet loss and low jitter resulting in a difference between Absolute MOS and Relative MOS due to fairly low stream resolution

2 MOS Stats MPEG2-TS Stats

MOS

PID	Class	Relative	Absolute	AV
256	Video	2.33	1.98	1.75
257	Audio		2.90	
258	Audio		3.64	

VMOS value for an SDTV stream with significant packet loss where audio PIDs were less distorted as the video PIDs consume a larger portion of the overall data flow and, therefore, increasing the likelihood of being hit by the loss event



VMOS test access with SmartClass TPS in Through/Monitor mode and Emulation mode

Conclusion

Testing only QoS metrics may not accurately represent a viewer's perceived experience of the IPTV service, which could result in churn for service providers or operators.

The SmartClass TPS VMOS test option for IP video testing provides a simplified number result that qualifies the perceived QoE of the viewer. Absolute MOS includes the total QoE for the consumer, including screen resolution, which impacts viewer convenience. In addition, Relative MOS can pinpoint IP stream transmission problems versus equipment issues with configuration, and AV MOS provides combined audio and video QoE analysis, including issues associated with lip synchronization.

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