

Solutions for

## Digital Video

### Ensuring Delivery of Quality, Standard-Compliant Digital Video Devices to Market

#### Application Note



#### Overview

Digital video is a hot topic these days and will likely remain so for the next 10 years—especially given that most countries have already begun to transition from analog television to digital video. Each country or region may elect to adopt a different digital video standard, as well as a standard for different transmission schemes (e.g., cable, terrestrial, satellite, and mobile video technology). For terrestrial transmission, for example, Europe employs the DVB-T (Digital Video Broadcasting-Terrestrial) standards, while North America, Japan and China utilize ATSC (Advanced Television Systems Committee), ISDB-T (Integrated Services Digital Broadcasting-Terrestrial) and DTMB (Digital Terrestrial Television), respectively. This wide range of standards presents an interesting challenge to equipment vendors and chipset manufacturers alike, both of whom must support the various standards now in the market. It also poses a challenge for telecommunications device vendors who are now moving to adopt mobile video applications in their mobile devices. Complicating matters further, the transition to digital video is expected to take a long time, during which existing technologies will likely evolve and new standards will emerge. Accommodating this emerging trend will require special test instruments with the flexibility to support the measurement of all the different digital video and transmission standards.

#### Problem

With the transition to digital video now underway, R&D engineers and manufacturers of digital video devices are being challenged to find ways to ensure quick delivery of quality, standard-compliant devices to market. Digital video receiver and transmitter testing plays a key role in achieving this goal. Since each test and standard has its own unique requirements, this task is daunting at best. Receiver test, for example, requires support for BER and subjective video test. Transmitter test requires support for power-related measurements (e.g., RF spectrum, channel power and LO phase noise), as well as post-processing capabilities and IQ analysis. Those utilizing receiver and transmitter tests also have their own unique requirements. Cost-sensitive manufacturers demand lower cost of test, while R&D engineers demand comprehensive test platforms capable of accommodating a range of tests (e.g., interference test, performance under AWGN and fading). Instrumentation is available today to conduct the necessary receiver and transmitter tests, but doing so while meeting continually evolving technology and application requirements now demands more flexible and scalable alternatives.



**Agilent Technologies**

## Solution

Highly flexible, general-purpose signal generation and analysis tools provide an optimal means of quickly and effectively conducting receiver and transmitter tests on today's digital video devices, while at the same time addressing evolving requirements. In contrast to technology- or application-specific measurement instruments, general-purpose signal generation and analysis tools cover most of today's digital video standards and are equipped with the performance and scalability necessary to adapt to the needs of the user, regardless of whether it is an R&D engineer or manufacturer. Moreover, because they can be utilized for a range of measurements with different standards, these tools significantly lower cost of test.

The general-purpose signal generator provides digital video standard-based signals for component test or receiver evaluation, including receiver sensitivity, adjacent channel rejection, BER, and subject video test. With the general-purpose signal analyzer, engineers utilize a range of standard-based power measurements and modulation analysis to detect, demodulate and troubleshoot digital video signals. Possible measurements include channel power, LO phase noise, shoulder attenuation, spectrum emission mask, constellation, MER/EVM, I/Q distortion, frequency error, and BER.

Agilent Technologies provides flexible and scalable, general-purpose test solutions designed to help R&D engineers and manufacturers quickly deliver quality, standard-compliant digital video devices to market. These instruments include the ESG and MXG vector signal generators running Signal Studio software, the PXB MIMO receiver tester and the MXA and EXA signal analyzers.

Agilent's signal source solution for digital video test comprises the ESG/MXG signal generators, Signal Studio software and the PXB multiple-channel baseband signal generator.

The PXB is well suited for digital video receiver test because it is a:

- **High performance, general-purpose solution.** High performance and accuracy help minimize design uncertainties and rework. Predefined channel models and menus for customizing path configurations allow the engineer to simulate the different test environments required by various conformance test specifications. Simultaneous support for multiple applications enables co-existence testing (e.g., analog TV and digital video).

- **Flexible, scalable platform.** A scalable architecture enables users to purchase only what they need today and then easily upgrade in the future to expand MIMO/configurations or add capabilities. Added flexibility comes from the instrument's ability to define up to 12 DSP blocks by the firmware for baseband generation or fading.

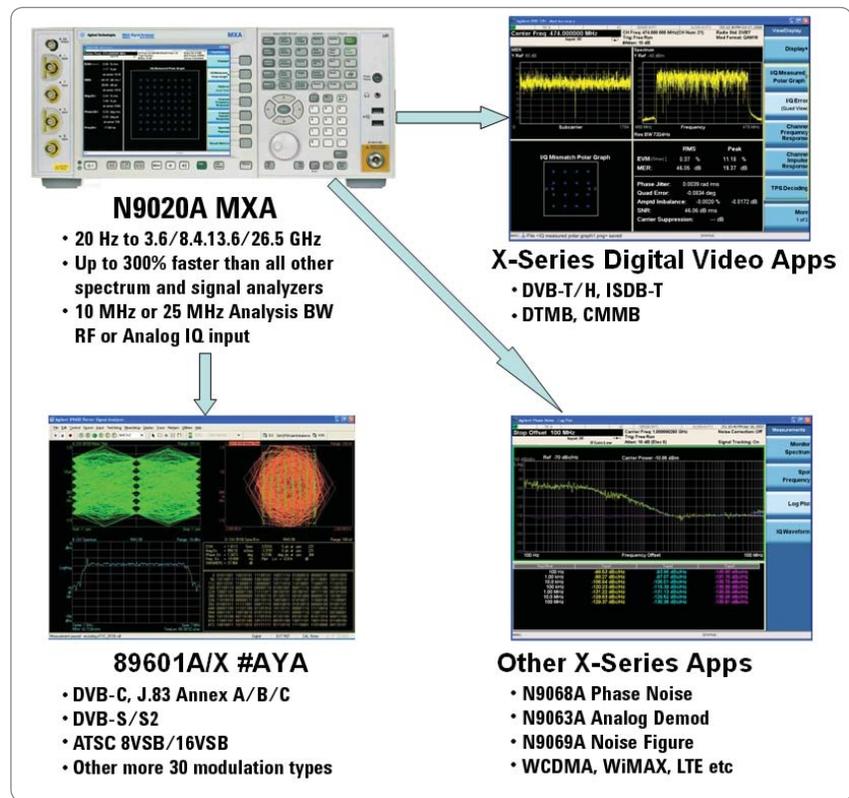


FIGURE 1: The EXA and MXA signal analyzers offer the same features, measurements and interfaces (both manual and remote), including more than 20 measurement applications and support for more than 50 modulation types. They are differentiated by their hardware performance.

Agilent's signal analysis solution for digital video test comprises the EXA and MXA signal analyzers and a set of digital video measurement applications that run on these instruments (Figure 1). With this solution engineers can perform one-button, standard-based power measurements and modulation analysis during the design, evaluation and manufacture of digital video transmitters and other digital video devices like digital TV modulators, amplifiers, tuners, gap-fillers/repeaters, and transposers.

The EXA/MXA signal analyzers are well suited for digital video transmitter test because they offer:

- **Flexible, scalable performance.** A speed of up to 300% faster than other spectrum/signal analyzers significantly lowers the cost of test, while a range of frequency options and a MER floor of more than 40 dB provide the flexibility and scalability engineers require today and tomorrow. Frequency options include: 3.6 GHz (recommended for digital video applications), 7.0 GHz (EXA only), 8.4 GHz (MXA only), 13.6 GHz, and 26.5 GHz.
- **A general-purpose, standard-based digital video solution.** A wide array of standard-based measurements can be manually set up to meet each users needs. Modulation accuracy measurements enable better transmitter troubleshooting.

## Digital Video Receiver Test Example

Digital video receiver test can be performed using the setup in Figure 2. Signal Studio, running inside either the ESG or MXG generates the signals (arbitrary waveforms) for component and receiver tests. The PXB then works with the ESG/MXG signal generators for IQ modulation and up-conversion to the RF signal. It plays the waveforms generated by Signal Studio and outputs analog and digital I/Q signals through Agilent's Digital Signal Interface Module (DSIM).

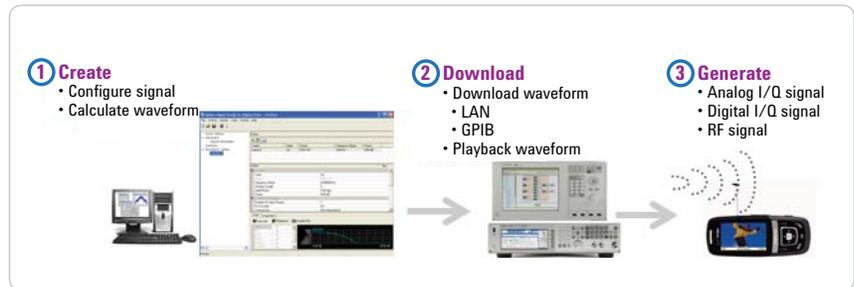
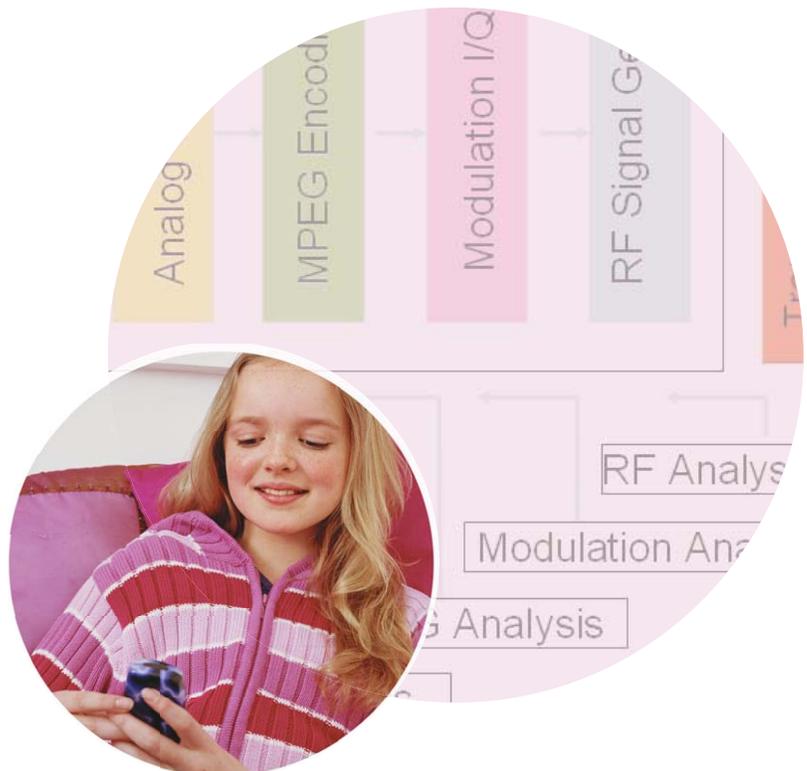


FIGURE 2: Signal Studio software is used with the different tools in Agilent's signal source solution to perform a range of measurements including BER and subjective video test with different payloads.



## Digital Video Transmitter Test Example

A wide range of component and transmitter use cases are possible using the setup in Figure 3. Using the MXA/EXA digital video measurement applications, with support for more than 50 modulation types, engineers can perform power measurements as well as modulation analysis. Additional digital video measurements can be obtained by combining the EXA/MXA signal analyzers with the Vector Signal Analysis (VSA) or VXSA signal analyzer measurement application with Vector Modulation option AYA (Figure 4). The VSA/VXSA with option AYA provides general-purpose modulation analysis with more than 30 different modulation types. Preset digital video standards can be used to measure DVB-C, DVB-S/S2 or ATSC standards. Engineers can even configure their own modulation format, symbol rate and filter type to measure other digital video standards like J.83 Annex B/C, DOCSIS2.0 or DOCSIS3.0.

## Summary of Results

Conducting the appropriate receiver and transmitter tests required for today's digital video devices is a difficult undertaking—one that is made all the more complex by requirements that come from continually evolving technologies and applications. General-purpose measurement solutions with the performance and scalability to adapt to the users needs like those now available from Agilent provide the most optimal means of addressing this challenge.

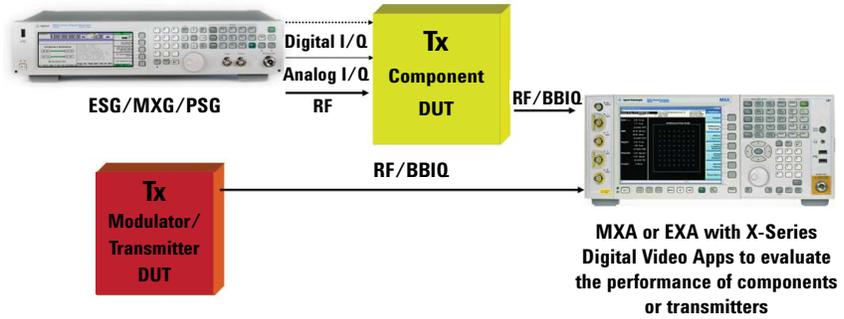


FIGURE 3: Agilent's digital video signal analysis solution can be used for a wide range of component and transmitter use cases.

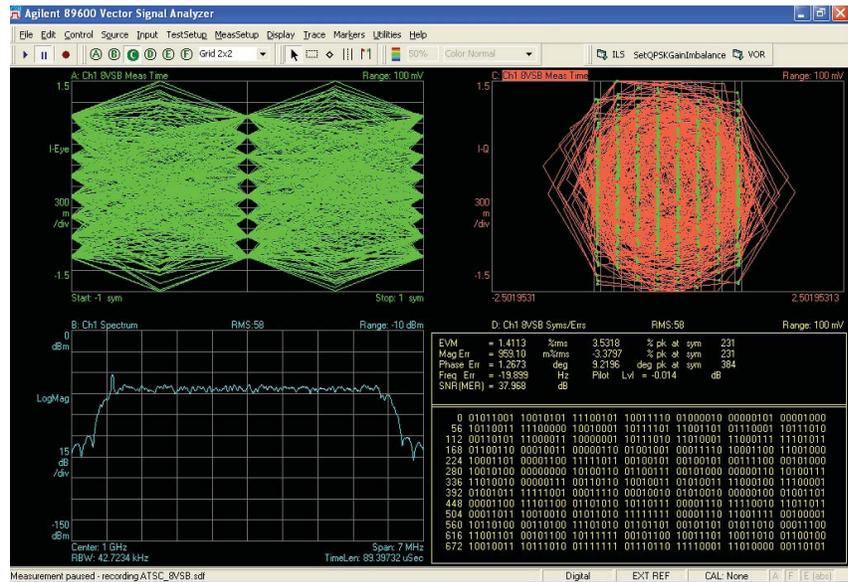


FIGURE 4: ATSC measurements can be easily performed using the 89601A with the AYA Vector Modulation option.



## The Power of X

The MXG signal generator, PXB MIMO Receiver Tester, and EXA and MXA signal analyzers are key products in Agilent's comprehensive Power of X suite of test products. These products grant engineers the power to gain greater design insight, speed manufacturing processes, solve tough measurement problems, and get to market ahead of the competition.

Offering the best combination of speed and scalability, and created and supported by renowned worldwide measurement experts, Agilent's X products are helping engineers bring innovative, higher-performing products to emerging markets around the globe. To learn more about Agilent's suite of X products please visit:

[www.agilent.com/find/powerofx](http://www.agilent.com/find/powerofx).

## Related Applications

- X-Series Advanced Measurement Applications (DVB-T/H, DTMB, CMMB, ISDB-T/Tsb, phase noise, noise figure, analog demodulation, WCDMA, LTE etc)
- 89601A Vector Modulation Analysis: Option AYA
- 89601X VXA Signal Analyzer Measurement Application
- N7623B Signal Studio for Digital Video
- N7611B Signal Studio for Broadcast Radio (FM/RDS, DAB/DAB+)
- N7616B Signal Studio for T-DMB
- E4438C-407 Signal Studio for S-DMB

## Related Agilent Products

- N9020A MXA Spectrum Analyzer
- N9010A EXA Spectrum Analyzer
- E444X PSA High Performance Spectrum Analyzer
- N9340B Handheld RF Spectrum Analyzer
- E4438C ESG Vector Signal Generator
- N5182A MXG RF Vector Signal Generator
- N5162A MXG ATE Vector Signal Generator
- E8267D PSG Vector Signal Generator
- N5106A PXB MIMO Receiver Tester



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vector signal generator

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E8267D PSG  
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