PRODUCT BROCHURE

Advanced Signal Processing & Analysis for the Laboratory

Test Signal Generation and Analysis

KEYSIGHT

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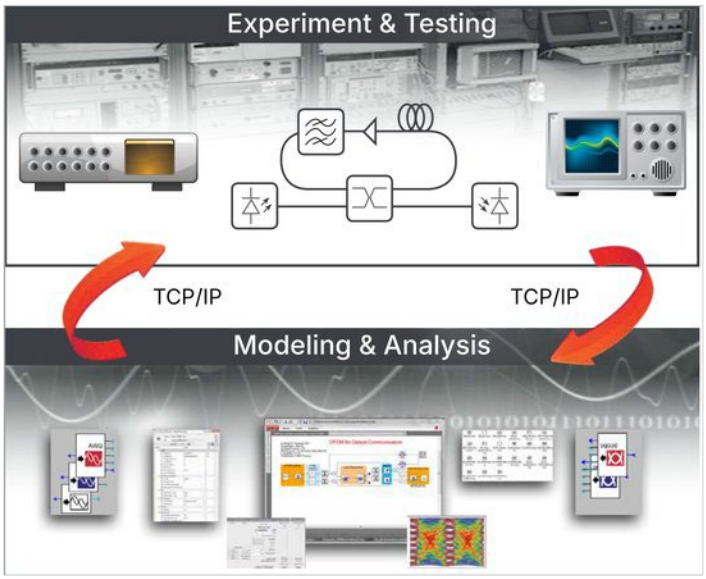
Keysight Test Signal Generation and Analysis (VPIlabExpert) addresses the requirements of experimentalists for data pre- & post-processing and signal analysis functions for optical communications. *VPIlabExpert* seamlessly integrates with Photonic Simulation Environment (VPIphotonics Design Suite), thus bringing new technology and design concepts developed in a simulation environment into the lab for verification and further development.

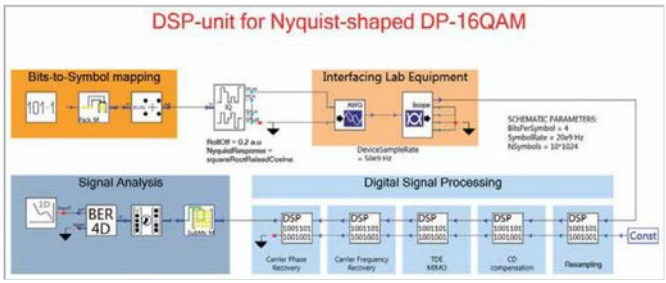
VPIlabExpert comes with a set of interface modules for automatic signal conversion and transfer between simulation software and lab equipment, flexibly allowing for user-specific requirements to be met and new equipment to be added.

VPIlabExpert's instruments interface enables sending signals created in Keysight's simulation environment to arbitrary waveform, bit-pattern, or vector signal generators. At the receiver-side, signals captured with real- or equivalent-time oscilloscopes and communication analyzers, can be read back into the software environment for DSP demodulation and performance analysis (BER, EVM and SNR estimation, constellation analysis, etc.).

VPIlabExpert supports experimental work and component specification in many different areas such as high-speed photonic transmission systems based on direct or coherent detection, microwave photonics, radio-over-fiber, free-space optical links, etc.



Benefits



- Reduce efforts in the lab by applying ready-to-use advanced functionalities
- Virtualize lab equipment by emulating transmission impairments and component characteristics
- Develop lab-ready signal-processing solutions using realistic simulations and advanced modeling
- Unify methodologies and tools for simulation and laboratory environments

Applications

- Generation, detection and performance analysis of advanced coding, shaping and modulation formats
- Offline processing of prerecorded experimental data
- Automated optimization of experimental settings
- Development and comparison of analog and digital predistortion and equalization techniques
- Definition of component requirements

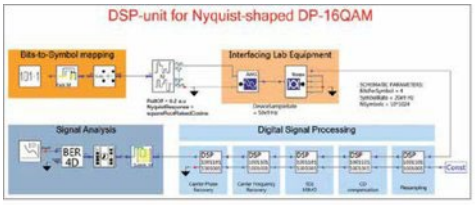
Features

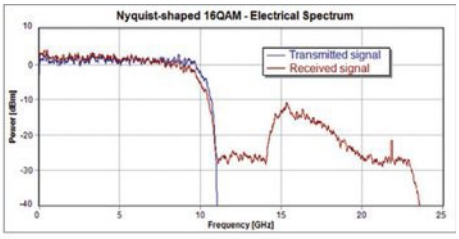
- Native instrument interface based on SCPI over TCP/IP
- VISA standard via Matlab or Python co-simulation
- Extensive library of lab modules supporting Arbitrary Waveform Generators, real-time/sampling scopes, vector signal analyzers/generators, bit-pattern generators
- Direct control interfaces to equipment from Anritsu, Keysight Technologies, SHF Communication Technologies, Tektronix, LeCroy
- Further support of lab equipment with National Instruments LabVIEW interface
- Arbitrary constellations including PAM-m, mQAM, PS-mQAM, 4D set-partitioning formats and others
- Single and multicarrier modulation (OFDM, DMT, FBMC, MultiCAP)

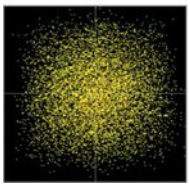
- Extensive library of blind, data-aided and pilot-tone based DSP algorithms (CR, pre-compensation, IQ imbalance, MIMO, FOC, CPR, FFE/DFE, Volterra, MLSE, DBP, ...)
- Extensive library of FEC encoders and decoders (LDPC, BCH, Reed-Solomon, Hamming)
- Access to lab-proven DSP libraries developed by Fraunhofer HHI via pluggable toolkit
- Analysis of Radio over Fiber (RoF) and microwave transmissions (SNR, CNR, IMD3, IP3,...)
- Advanced visualization and analysis tools (SER, BER, EVM, OSNR, eye-diagram, spectrum, TDEC and TDECQ,...)
- Automated optimization via scripts (Matlab, Python, tcl)

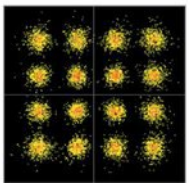
Design Examples

Nyquist-Shaped DP-16QAM System



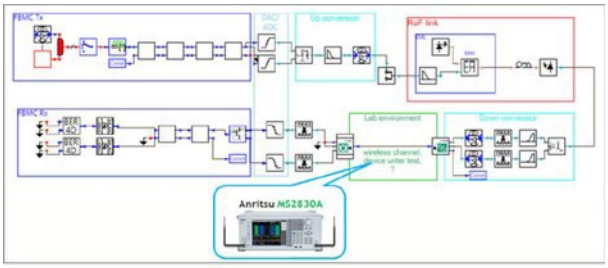


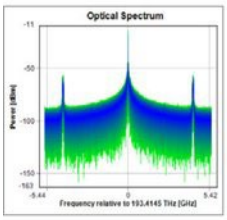


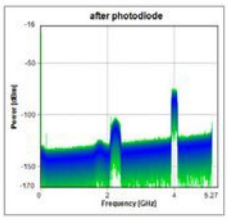


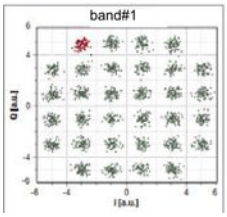
- A 20 Gbaud Nyquist-shaped 16QAM signal passed into a 2-channel Arbitrary Waveform Generator (AWG) driving an optical IQ modulator
- After fiber propagation the signal is detected using a polarization-diversity coherent receiver with a free-running local oscillator
- Digitized signal retrieved from the scope and processed by *VPIlabExpert*
- Digital demodulation/equalization performed using the DSP_Lib module, which offers a rich library of DSP algorithms for various modulation formats

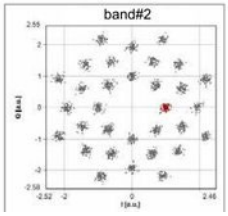
RoF for Distribution of 5G Services





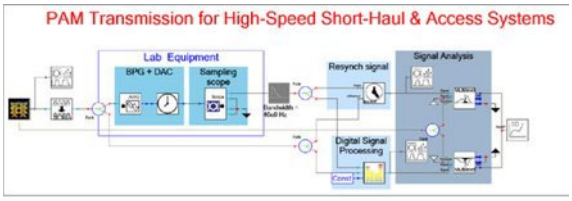


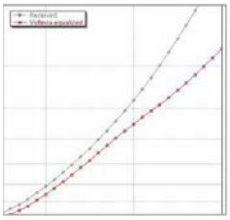


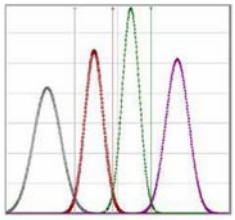


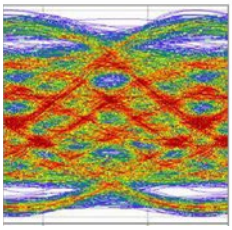
- A 320 Mb/s OFDM signal is generated with 80 MHz RF bandwidth
- Propagation over a Radio-over-Fiber (RoF) link is simulated on a 4 GHz carrier
- After the RoF link, the baseband signal is passed to the Vector Signal Generator (VSG) of an Anritsu MS2830A for wireless transmission on a 2 GHz RF carrier, captured by the Signal Analyzer (SA) of the MS2830A
- Signal returned to *VPIlabExpert* for further processing (synchronization, decoding) and analysis (subcarrier-wise EVM and BER estimation)
- Optimization of the design of the RoF link is allowed (e.g., trade-off between SNR and intermodulation distortion) and comparison with other technologies such as Filter Bank Multicarrier (FBMC)

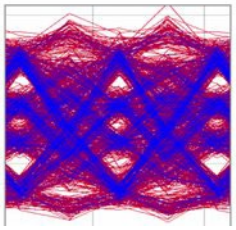
PAM for Data Centers & Access











- Bit pattern generator is controlled, combined with a DAC to transmit a 56 Gbaud PAM-4 signal
- After transmission over a short span of fiber, the signal is directly-detected and captured by an oscilloscope
- Adaptive Volterra-series equalizer is employed to compensate for both linear and nonlinear distortions introduced by the transceiver components and fiber
- Probability density functions of each symbol are calculated and the BER is estimated

As a mission-critical design enablement partner, Keysight connects design, emulation, and test so customers can solve the world's most complex engineering challenges. Accelerate innovation at www.keysight.com.

KEYSIGHT

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