



Triple-Play Services over FTTx

Complete Test and Service Assurance Solutions
for the Delivery of Voice, Video, and Data Services

Triple-Play Services over FTTx

Successful triple-play deployment demands an application-aware test strategy

Service providers today compete in a market where there's more pressure than ever before to maximize revenue through additional service offerings, decrease cost of ownership and maximize profits through efficient network management. Yet through the far-reaching communications industry trend commonly known as "triple-play" services, consumers are enjoying unprecedented opportunity for bundled voice, video and data services. The more competitive the offerings available to the consumer, the more critical it becomes for providers to ensure that their service offerings meet users' strict quality of experience (QoE) expectations.

Sustained market viability demands that service providers evolve their existing networks to withstand the rigors of bandwidth-intensive triple-play applications. The deployment of broadband access networks that bring optical fiber near or to the customer premises (FTTx) and new in-home distribution technologies are integral to this evolution. Successful triple-play deployment is possible only through comprehensive planning and well-defined test and management strategy. JDSU, the industry leader in broadband communications test and measurement solutions, has set the standards for ensuring reliable triple play over FTTx service deployment. With unmatched global experience and a portfolio of industry-standard service assurance and network test solutions, JDSU is uniquely positioned to help service providers maximize their triple-play services market potential.

JDSU's portfolio of triple play over FTTx test and measurement solutions is unrivaled in breadth and depth, providing true application-aware end-to-end triple-play testing and service assurance for voice, video and data. JDSU offerings including field test equipment, lab equipment, centralized test and monitoring solutions and services give providers the tools they need to successfully deliver triple-play services over FTTx.

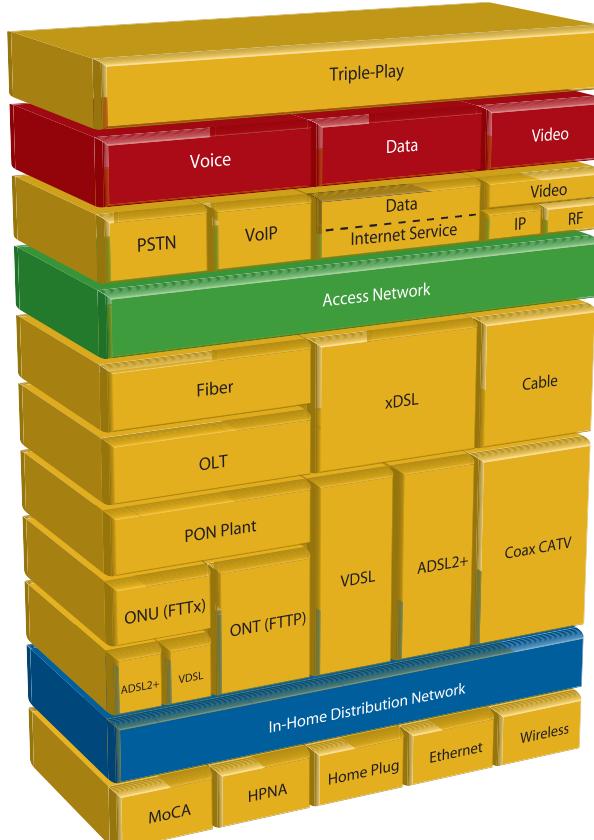


Triple-Play Building Blocks

The rapid adoption and evolutionary nature of triple-play services over FTTx has resulted in a myriad of scenarios for delivering the voice, video and data bundle to the customer. Ultimately, providers will push services out from the core to the edge over an infrastructure comprised largely of optical components and fiber. But the pace of competition demands that while new networks are being built out, existing ones must be retrofitted to capitalize on the market opportunity.

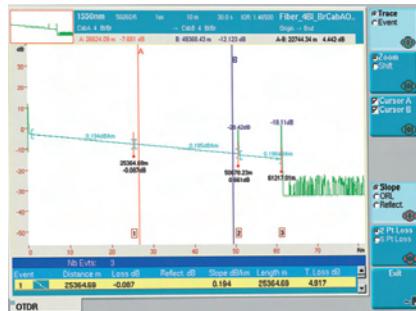
FTTx encompasses the entire set of network architectures that are enabling providers to bring broadband services to the customer premises today. Fiber may or may not extend all the way to the premises as it does in FTTP (fiber to the premises) architectures. An xDSL technology, such as ADSL2+ or VDSL, may be used in the last mile from the fiber node to the customer premises equipment. It is important to note that even in FTTP, the in-home distribution network is a critical part of the last-mile delivery of triple-play services.

Regardless of how the triple-play network building blocks are stacked, providers must ensure that the end result is the same—solid construction which ensures the QoE customers expect. With support for the full span of triple-play delivery topologies, JDSU solutions help providers achieve this goal.



JDSU products and services support the entire system of infrastructures and technologies that interconnect to lay the foundation for triple-play services delivery

Testing the FTTx Network for Triple Play



JDSU's physical plant qualification tools feature easy-to-interpret displays and give technicians single-touch access to critical data for certifying FTTx networks



T-BERD/MTS 6000 Compact Optical Test Platform

Establishing a competitive triple-play services offering presents different challenges at each phase of the network lifecycle. Service providers need a test strategy that ensures connectivity and quality on the day of turn-up as well as fast isolation and resolution of trouble that may arise in a live network. This strategy begins with establishing the readiness of the physical plant to support the simultaneous delivery of broadband voice, video and data.

Physical Plant Installation and Troubleshooting

Qualifying the Fiber

The first consideration for reliable triple-play services delivery is fiber plant qualification—analyzing both the fiber and the serving terminals to ensure:

- End connector quality
- End-to-end optical transmission performance - insertion loss (IL) and optical return loss (ORL)
- Correct optical power levels at terminals

During FTTx network qualification, technicians compare values taken in the field with engineering design parameters to verify fiber paths, distances, connectors, splices and link losses (IL/ORL). During provisioning, a specialized FTTx power meter is used to ensure reliable operation based upon transmission standards used between the serving terminals. During on-going maintenance, technicians must troubleshoot transparently to resolve problems and restore service without impact to other customers by using “out-of-band” 1625 nm OTDRs and live traffic detectors/fiber identifiers.

JDSU offers a range of instruments that perform these critical fiber plant qualification requirements. The SmartClass optical handhelds, OFI-2000 Bi-directional Optical Loss Tester, MTS-5100 OTDR Tester, T-BERD™/MTS 6000 Compact Optical Test Platform, and T-BERD/MTS 8000 certify fiber plant quality and keep triple-play services up and running. For remote test applications where faults can be detected and located automatically, JDSU offers the Optical Network Management System (ONMS) solution.



JDSU solutions
build network
connectivity
throughout the
network lifecycle



Test-Um NT-950 Validator™ Network/Cabling Certifier

Qualifying Copper for xDSL

Maximizing existing infrastructures means qualifying the copper xDSL access plant to carry high speed services. Here, physical-layer parametric testing is crucial. Providers must test for:

- Foreign voltage
- Leakage resistance
- Capacitive balance
- Longitudinal balance
- Loop length
- Wideband noise

As data rates continue to increase, requiring the use of wider frequency spectrums, identification of wide band noise and analysis of pair balance become increasingly important. Technicians worldwide use the HST-3000 Handheld Services Tester to carry out these important tests. The HST-3000 is one of the industry's most versatile field test tools, capable of performing complete copper and xDSL qualification tests as well as application layer testing, all in a single, modular, portable platform. For service providers needing a turn-up and troubleshooting tool for ADSL2+ only, the SmartClass ADSL2+ field tester is designed to perform all necessary qualification tests with unmatched ease of use and speed. For service providers seeking a cost effective centralized approach for efficiently monitoring and testing customer xDSL lines and services, JDSU NetComplete™ Service Assurance solution for xDSL combines service pre-qualification testing, problem detection, segmentation and troubleshooting capabilities with narrowband and wideband copper testing.

Qualifying the In-Home Network for Triple-Play Services Distribution

The quality of the customer's triple-play services experience depends upon the quality of the in-home distribution network. Interactive video services require a reliable connection between the set top box (STB) and the residential gateway. To ensure this connection for reliable triple-play network installation, the technician must:

- Identify and eliminate service-impairing components
- Validate wiring integrity
- Test for proper service levels

JDSU's in-home wiring test portfolio enables service providers to fully qualify the home network for successful delivery of triple-play services by carrying out essential tasks including metallic testing (opens, shorts, mis-wires), IP/Ethernet testing, wireless 802.11b/g and video home networking qualification (HPNAv3 and MoCA).



Testing the FTTx Network for Triple Play

Service Provisioning, Assurance and Maintenance

Each service component of the triple play carries its own unique testing and maintenance considerations. In every case, customers have previous experiences—and therefore set expectations—of acceptable service delivery for voice, video and data because virtually everyone already talks on the phone, watches subscription-based TV and surfs the Internet. As providers entice customers away from traditional service delivery methods, they must prepare to provide services more efficiently and economically to satisfy QoE expectations in an increasingly sophisticated market.

IP Voice

When turning up or troubleshooting triple-play voice service or voice over IP (VoIP), field personnel must verify:

- Connectivity to signaling gateways
- Service provisioning
- Call quality

Call quality should be verified by placing both on-network and off-network (to PSTN) test calls. Critical test call parameters include packet delay, loss and jitter. However, the mean opinion score (MOS) will be the most critical measure of overall VoIP quality and service level agreement (SLA) compliance.

In the service assurance phase of VoIP delivery, a variety of issues can cause poor service quality. These include:

- Customer premises equipment quality
- Network echo canceller performance
- Network packet performance

Network hand-offs between the packet network and the TDM network, typically managed by a voice gateway switch, are critical test points in all networks.

The JDSU HST-3000 provides the full complement of VoIP field tests. And for telecom and cable service providers who require triple-play service assurance solutions, the JDSU NetComplete for VoIP test system enables complete end-to-end QoS testing and monitoring using both active and passive approaches. For cable providers, NetComplete integrates RSAM and PathTrak™ to provide NOC personal the ability to detect and segment problems between the IP network and the RF network with visibility into both the upstream and downstream paths.



HST-3000 Handheld Services Tester

JDSU solutions build assurance to meet customers' QoE expectations



JDSU IP Video test solutions drill down into the transport stream to perform comprehensive MPEG analysis so that technicians can identify and correct errors before customers experience image drop-out, tiling or freezing

IP Video

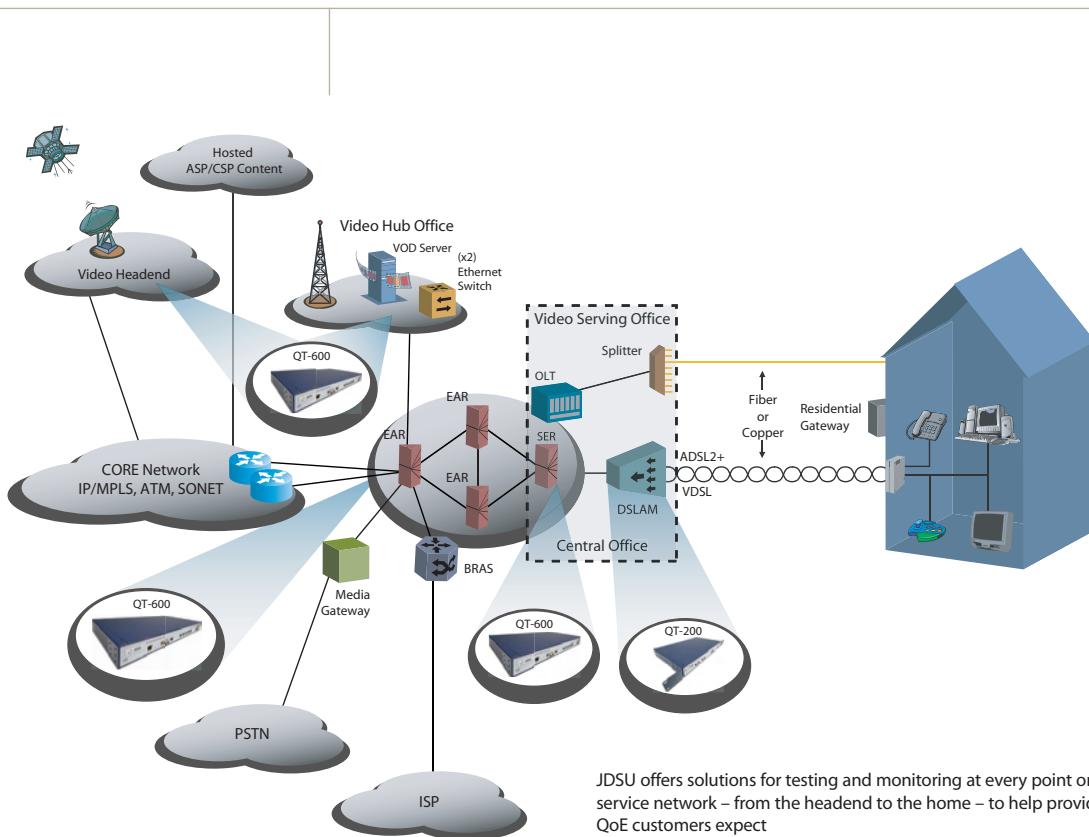
Service providers deploying IP video as part of their triple-play services offering face challenges that are both new and complex. First among these is the ability to verify the quality of digital video content and transport. MPEG transport layer problems can take days to solve without complete MPEG testing capability at multiple points in the network, particularly since problems at this layer may not be visible at the IP layer. This content stream testing should be performed at all key network hand-over points from the video headend to the access network. Historically, MPEG analyzers have been limited to asynchronous serial interfaces (ASI), but today engineers and technicians need to be able to simultaneously test different interfaces, such as DVB, ASI, QPSK, QAM and especially GbE. The JDSU TruStream™ portfolio offers service providers a total digital video and IPTV test solution for analyzing and monitoring content streams across all interfaces at all key locations in the network.

In the access network, field personnel must rely on their test equipment to verify three areas of performance prior to IP video service turn-up. These include:

- Adequate xDSL performance
- Video service provisioning
- Video QoS

Test equipment must be able to emulate the customer's STB, obtain and validate video program flows and QoS values established by each service provider for each parameter. Among the most important of IP video QoS parameters to test are program clock reference (PCR) jitter, IGMP latency and video packet loss. If PCR jitter is too high, video decoding will not function properly. A high IGMP latency will result in delays in channel change, negatively impacting customer experience. Packet loss will impact video decoding.

Testing the FTTx Network for Triple Play



Video 1 QoS				
HOME->ETHERNET->ETHERNET TE				
Current	Max	Score	Hist.	
PCR Jitter	4 mS	5 mS	Pass	Pass
Latency	300 mS		Pass	Pass
Cont. Err	0.1 %	0.1 %	Pass	Pass
Overall: Pass				
Display ▲ Actions ▲ Results ▲				

The HST-3000 evaluates and clearly displays key IP video QoS parameters

To help service providers manage the complexities of successfully deploying IP video in the field, the JDSU HST-3000 comes equipped with the measurement and analysis features that quickly identify, characterize and isolate fault conditions from the physical layer through the video application layer. To ensure an ongoing positive customer QoE, NetComplete can proactively optimize line provisioning and monitor xDSL performance.

High Speed Data

To provide triple play over FTTx subscribers with Internet connectivity for high speed data (HSD) service, Internet service provider (ISP) accounts must be established for each customer and traffic planning must be modified to accommodate additional data flow. The impact on broadband remote access servers must be evaluated and management plans for control/routing and bandwidth planning completed. Additionally, the following configuration and test procedures should be completed prior to turn-up:

- Establish connectivity to the ISP
- Provision necessary network elements for increased data flow and class of service treatment
- Reconfigure DSLAM ports for dual latency path support for the mixed IP application environment



The HST-3000 Web browser functionality verifies Internet connectivity and expedites close-out



QT-200 xDSL & Triple-Play Probe

To complete the installation process, field personnel must verify DSL physical layer performance, ISP connectivity and ISP and data service throughput. A test tool with Web browser and FTP throughput test capabilities can carry out these tasks. Using selectable test file sizes and performing both up-load and down-load testing, FTP throughput tests establish performance of the link that more closely models actual use cases than a simple download test. HTTP testing using a Web browser ensures that the end users' ISP access/connectivity is working properly.

In addition to its application-aware test capabilities for VoIP and IP video testing, the JDSU HST-3000 is equipped to perform Internet data application tests, making it the ideal field test tool for triple-play service provisioning and quality assurance.

To ensure high QoE after service is turned up, providers must detect, isolate and resolve problems before customer service is affected. For worry free service level maintenance, JDSU offers NetComplete Service Assurance for xDSL—a solution that includes testing and troubleshooting, performance monitoring, optimization and capacity management applications. When a customer-reported problem does occur, providers can rely on the functionality of NetComplete to analyze the physical layer as well as the services on it to quickly identify and segment the problem. Then, the correct technician, with the correct tools, can be dispatched to the trouble source to implement the resolution.

NetComplete supports data, VoIP and IPTV applications by combining powerful OSS performance monitoring and testing with remote probes and software agents. Strategically placed in the network, the JDSU QT-50, QT-200, and QT-600 communicate with centralized NetComplete software to identify and troubleshoot copper, DSL and triple-play service problems.



JDSU—The Single Source for Triple-Play Test Solutions

***JDSU solutions
build certainty***

Deploying triple-play services over FTTx brings vast complexity to network planning, testing and maintenance. A comprehensive, application-aware test and service assurance strategy that encompasses installation, provisioning and management is the single solution to address these challenges. And JDSU is the industry's single source for these solutions. The JDSU portfolio brings service providers certainty that networks will perform as promised through complete capability to verify and troubleshoot the physical plant, the network circuit and the full suite of broadband IP service offerings.

JDSU products are available to test and monitor at every point on the FTTx network. Complementing the JDSU product portfolio is a range of FTTx-targeted service solutions including Education, Test Equipment Management and Consulting. Following is a brief overview. Contact a JDSU Sales Engineer or visit www.jdsu.com for complete information on all products and services.

Plant Installation	Service Provisioning	Maintenance & Troubleshooting	Service Assurance
---------------------------	-----------------------------	--	--------------------------

JDSU Triple-Play Test Solutions

Handhelds



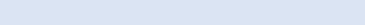
DSAM Digital Service Activation Meter

The DSAM is an all-in-one field test meter for testing both digital and analog video services and IP performance over RF or Ethernet interfaces.



FST-2802 TestPad

The FST-2802 is a handheld Ethernet, Fibre Channel and IP services test instrument designed to meet turn-up and troubleshooting needs. The FST-2802 enables technicians to use one test set to turn up services ranging from 10/100 Ethernet, Gigabit Ethernet, Fibre Channel, and IP from a single TestPad module.



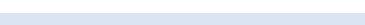
HST-3000 Handheld Services Tester

The HST-3000 is a handheld, modular platform for copper and multi-service testing. Lightweight, rugged and battery-operated, the HST-3000 cost-effectively scales to provide an all-in-one solution for field installation, maintenance and troubleshooting of voice, video and data services. Its automated testing features enable improved productivity and work-process efficiency. The HST-3000 is a Workflow Solutions-enabled platform.



IVT-600 TriPorter™ Network Qualification and Testing Tool

The IVT-600 is the test solution for IPTV, VoIP, home networking, whole-home DVR, and residential gateway installation. It combines a full suite of features for performing essential tasks including coax/cat-5/3 testing, wiremapping, outlet identification, basic Ethernet testing, network capacity verification, POTS-SLIC emulation, tracing, and advanced tone generation.



MTS-5100 OTDR Tester

This handheld mini-OTDR tests both single mode and multimode fiber networks, and is ideally suited for FTTx applications. Designed for fiber installation and maintenance, the MTS has become the worldwide reference for OTDR testing with its field upgradability and simple migration path to new network technologies.



OLP-57 SMART Optical Power Meter

The OLP-57 SMART 1310/1490 nm or 1310/1490/1550 nm Selective Optical Power Meter with storage capability and long battery life is designed for turning up and maintaining FTTx networks, including PONs.



OFI-2000 Bi-directional Optical Loss Tester

The OFI family is a timesaving platform for automatic bi-directional loss and ORL measurements, with VFL and talk set options. The OFI-PON, working at 1310/1490/1550 nm wavelengths, is the latest addition, extending applications to FTTx services.



Handhelds (continued)



SmartClass Optical Handheld Test Tools

The SmartClass portfolio of test tools provides the triple play of intelligence, power and portability to characterize the physical layer of FTTx networks. With SmartClass, technicians have the right handheld test tools (including power meters, sources, ORL meters and talk sets) for the job at hand.



T-BERD/MTS 6000 Compact Optical Test Platform

The T-BERD/MTS 6000 (MTS-6000) is a compact and lightweight test platform designed for the installation and maintenance of fiber networks. Modular in design, the T-BERD/MTS 6000 offers an impressive portfolio of test functionality, with over 40 different fiber modules supporting a wide range of applications, and is a single source for future fiber and photonic testing needs.



Test-Um LB-255 Ranger™ DSL-Safe Test Set

The LB-255 features all standard butt-set functionality in addition to incorporating advanced features such as DigiView™ DTMF Decode to see and capture digits as a dial-out is in progress, ADL™ Auto Dial Line Identification inbound/outbound line identification and caller ID testing, Trafix-guard™ to sense digital lines and identify under/over voltage conditions, and Insta-Talk™ amplification speaker with simultaneous intercom capability for talking while testing.



Test-Um NT-950 Validator Network/Cabling Certifier

The NT-950 Validator uses a four-step methodology—layout, certify, document, and archive—for professional and cost-effective installation in the customer's home. The Validator measures and presents fast, clear speed and performance results at up to 1 gigabit to ensure that cabling operates as rated and network components operate at maximum efficiency.



Test-Um TP-300 Resi-Tester™ Whole-House Cable Tester

The TP-300 Resi-Tester is a complete solution to identify and verify all wiring environments found in home networking and home automation. It tests and locates CATV, telephone systems, audio cable, security/alarm wiring and network cabling. In addition, the Resi-Tester features multiple in-put ports and includes a variety of adapter cables so that any wire can be attached and tested.

Portables



DTS-200 MPEG-2 Field Instrument

The DTS-200 Digital Broadcast Field Test Tool is a portable MPEG-2 solution offering full remote operation from the office, lab, or home. It performs real-time analysis to verify stream contents, service plans, PIDs, rates, timing parameters, and ETR-290. It automates testing for baselining with event logs, triggers, and reports. The DTS-200 is a TruStream Digital and IP Video Test and Monitoring Solution.



DTS-330 Digital Broadcast Test Platform

The DTS-330 Digital Broadcast Test Platform is a comprehensive MPEG-2, MPEG-4, DVB and ATSC test solution providing transport stream generation, capture and analysis. The DTS-330 is a TruStream Digital and IP Video Test and Monitoring Solution.



T-BERD/MTS-8000

The T-BERD 8000 (MTS-8000) is a field-scalable optical test platform and the industry's most innovative and cost effective test solution for both metro and FTTx networks. Providing physical layer test modules including OTDR, PMD and CD and service layer test modules such as 10 gigabit Ethernet and SDH/SONET, it allows thorough testing of FTTx, CWDM and DWDM networks.

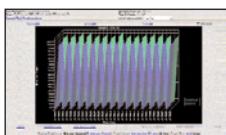


Service Assurance

NetComplete Solutions

Broadband Tools

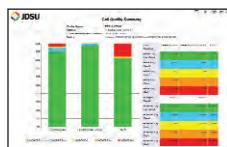
Broadband Tools is a suite of software tools enabling engineers and operations personnel to improve broadband network management including performance optimization of xDSL services, broadband fault isolation and capacity planning and management.



NetAnalyst Test Management OSS

NetAnalyst is a powerful carrier class test OSS that centralizes crucial test creation and management functions. Service providers can create customized, pre-defined, repeatable tests and schedule them to run automatically, reducing user-induced errors and allowing specific trouble areas to be quickly detected and isolated.

Service Assurance (continued)



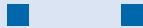
NetOptimize Performance Management and Capacity Planning OSS

NetOptimize is a carrier-class Performance Management software application. It combines service and network performance monitoring and capacity management with a fully scalable architecture that keeps pace with network and subscriber growth for triple-play services. NetOptimize correlates network, quality, and customer data to fully qualify the customer experience in addition to identifying and proactively predicting network and service problems.



QT-50 Software Agent

The QT-50 is a light-weight, low cost software agent targeted for deployment at the customer premises. Seamlessly integrated with NetAnalyst and NetOptimize, the QT-50 can generate active test calls to measure the end-to-end QoS proactively and reactively report on customer QoS.



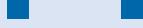
QT-200 xDSL & Triple-Play Probe

The QT-200 xDSL & Triple-Play probe and NetAnalyst Test Management Software, provide unsurpassed ability to pre-qualify, provision, maintain, monitor and troubleshoot DSL triple-play services as well as copper loop and POTS lines.



QT-600 Ethernet IP & Triple-Play Probe

The QT-600 is a carrier-grade, scalable, multiservice IP Ethernet test head. Through proactive traffic monitoring, the QT-600 detects patterns of QoS degradation and, from a centralized location, quickly segments the network to identify the source of the problem. The detailed view of network and service performance that is the by-product of the QT-600's distributed data gathering and consolidated reporting capabilities instills service providers with confidence to guarantee service level performance.



JDSU Services for Triple-Play Success



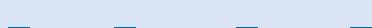
Consulting Services

New service deployment creates the need for more equipment, more manpower, more expertise and unbiased test results. Support your current workforce with experienced test engineers, or automate your method of procedures (MOPs) to reduce testing time and testing complications.



Education Services

Renewed education is a must have for the rapidly changing environment created by triple-play services and FTTx deployment. JDSU's Education Services group provides training and development of new method of procedures (MOPs) in addition to hands-on and virtual training on new technology, testing practices and products.



Test Equipment Management

Solutions spanning from calibration and repair to detailed RFID test equipment tracking allow installers, providers and equipment manufacturers to achieve the highest return on test equipment investment by increasing test equipment utilization and internal efficiency in tracking equipment.



All statements, technical information and recommendations related to the products herein are based upon information believed to be reliable or accurate. However, the accuracy or completeness thereof is not guaranteed, and no responsibility is assumed for any inaccuracies. The user assumes all risks and liability whatsoever in connection with the use of a product or its application. JDSU reserves the right to change at any time without notice the design, specifications, function, fit or form of its products described herein, including withdrawal at any time of a product offered for sale herein. JDSU makes no representations that the products herein are free from any intellectual property claims of others. Please contact JDSU for more information. JDSU and the JDSU logo are trademarks of JDS Uniphase Corporation. Other trademarks are the property of their respective holders. ©2007 JDS Uniphase Corporation. All rights reserved. 30137300 003 0907 TRIPLEPLAYFTTX.BR.ACC.TM.AE

Test & Measurement Regional Sales

NORTH AMERICA	LATIN AMERICA	ASIA PACIFIC	EMEA	WEBSITE: www.jdsu.com
TOLL FREE: 1 866 228 3762 FAX: +1 301 353 9216	TEL: +55 11 5503 3800 FAX: +55 11 5505 1598	TEL: +852 2892 0990 FAX: +852 2892 0770	TEL: +49 7121 86 2222 FAX: +49 7121 86 1222	