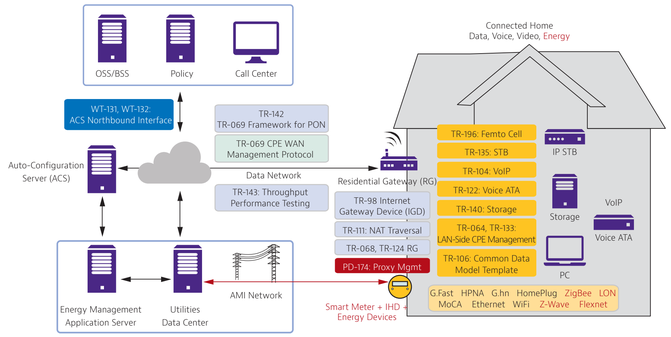
Viavi Solutions™ — Your xDSL Testing Solutions Partner

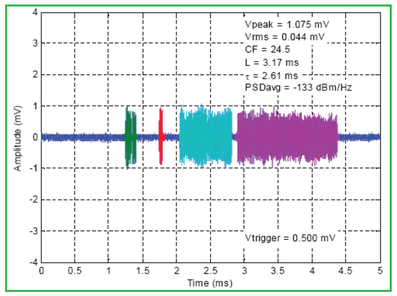
Troubleshooting and Fixing Copper Pairs

Measurement	Identifies	Next steps
VDC	Cross battery indicates contact between the test pair and another working circuit.	Use Resistive Fault Locate (RFL) to locate a fault. Remove it and retest.
VAC	Dangerous or hazardous voltage.	Use Power Influence and NB spectral to locate source, possibly TDR.
Circuit Resistance (Leakage)	Resistive fault shorts/grounds indicate that the test pair is in contact with ground or that tip and ring (a/b/earth) are in contact with each other. Low-resistance (<100 Ohm) connections across tip and ring can be located with TDR. High-resistance connections across tip and ring require separate good pair RFL.	Use RFL to locate a fault. Remove it and retest. Auto TDR if fault is across tip and ring and less than 100 Ohm.
Opens (Loop Length)	Loop Length determines if the pair is too long to support digital service or is longer than your cable records show.	Loop Length can be verified with Auto TDR. Or perform a capacitance measurement by shorting the tip and ring leads and measuring resistance from the far end using the Ohm to Feet function. Repair fault (possible bridged tap) and retest.
Capacitive Balance	Capacitive Balance indicates differences in conductor length. Failures can be the result of open or partially open conductors.	Locate open with Auto TDR. Repair fault and retest.
Bridged Tap Detect	Bridged taps degrade digital service and should be removed.	Locate the bridged tap with Auto TDR. Remove bridged tap and retest.
Longitudinal Balance	Pair balance is the measurement of overall pair quality. Values <60 dB indicate physical trouble.	Test pair balance problems using the Auto TDR, which should find most problems. Locating small balance problems may require sectionalizing the cable using the old divide-and-conquer method.
Power Influence	High Power Influence is the measurement of induced noise from the power system.	Ensure proper bonding and grounding at all ready-access terminals and retest.
Circuit Noise	Circuit Noise is the measurement of audible noise heard by the customer. Most noise is caused by physical problems (shorts, grounds, or opens).	Correct physical trouble or lower Power Influence.
Load Coil	Left in place, load coils "block" or severely attenuate digital signals.	Use Load Coil detection test to verify the presence of load coils. Next, use the Auto ID TDR to determine the location of the load coil. Remove load coil and retest.
Impulse Noise	Transient noise signals that appear in extremely fast bursts and are usually associated with unshielded wire within the proximity of electrical equipment.	Check unshielded wire within the proximity of electrical equipment, replace it, if necessary, with shielded cable and retest.
WB Noise	Wideband Interferes refer to any unwanted signal within the same bandwidth as your DSL service. Failures can result from physical trouble or too many digital services in the same binder group. Another potential cause is adjacent DSL service in trouble.	Ensure no physical troubles exist. Verify that bonds or grounds are not loose or missing and then verify that pair balance is acceptable and retest.

Broadband Home Remote Management



Impulse Noise and Spectral



VDSL is more susceptible to impulse noise events due to its use of a wider frequency spectrum than ADSL. Noise sources are being analyzed in several forms:

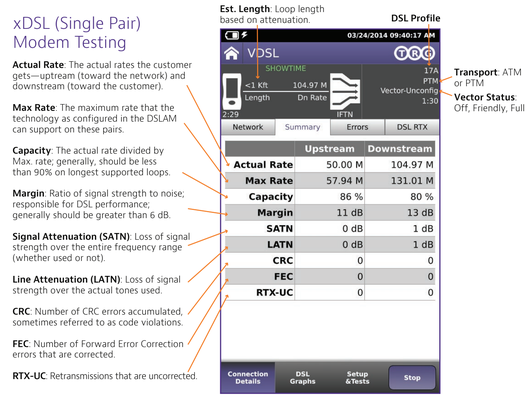
REIN (Repetitive Electrical Impulse Noise)
- Duration of less than 1 ms
- No bit errors desired
- INP mitigation

PEIN (Prolonged Electrical Impulse Noise)
- Duration of 1 to 10 ms
- No bit errors desired
- INP mitigation

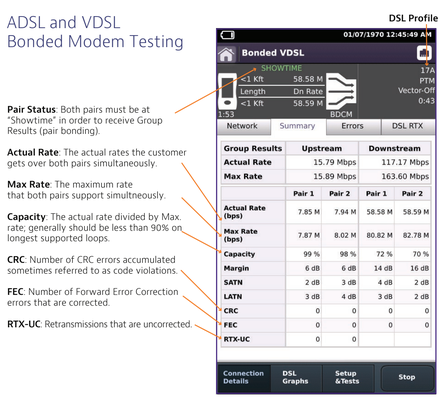
SHINE (Single Isolated Impulse Noise Event)
- Duration greater than 10 ms
- Due to duration, bit errors typically occur
- No loss of sync is desired

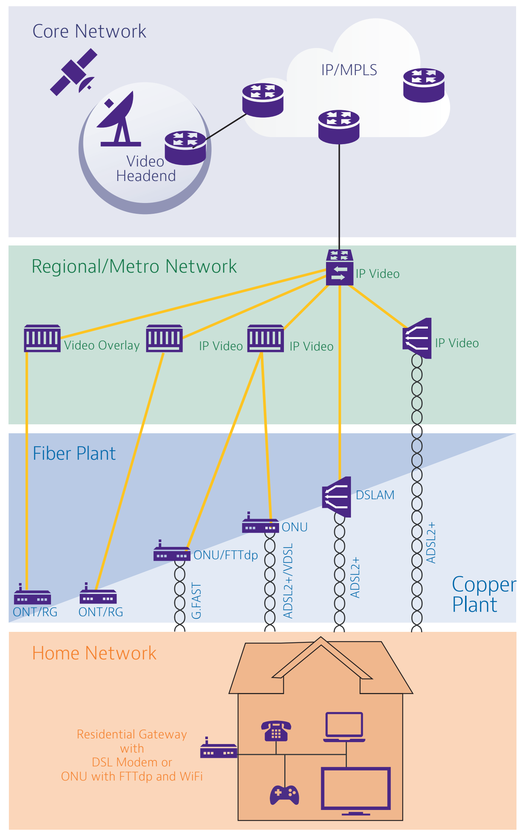
DSL Statistics and Results

xDSL (Single Pair) Modem Testing



ADSL and VDSL Bonded Modem Testing



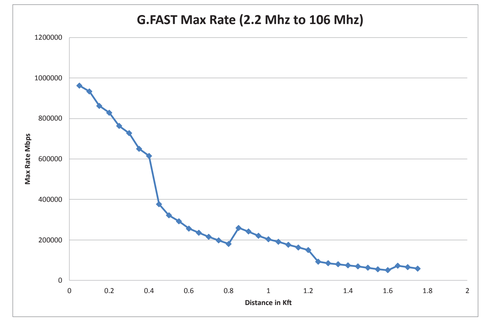


ITU-T xDSL Recommendations Evolution

Technology	ITU-T Standard	Also known as	Year
ADSL	G.992.1	G.dmt	1999
ADSL lite	G.992.2	G.Lite or "Splitterless ADSL"	1999
SHDSL	G.991.2	G.shdsl or "G dot"	2001
ADSL2	G.992.3	G.dmt bis	2002
ADSL2 lite	G.992.4	G.lite bis	2002
ADSL2 plus	G.992.5	ADSL2+	2003
ADSL2	G.992.3 Annex L	RE-ADSL2 or "Reach Extended ADSL2"	2003
SHDSL	G.991.2	SHDSL bis or "G dot bis"	2003
ADSL2/2+	G.992.3/5 Annex M	ADSL2/2+ Upstream Extended	2003
VDSL	G.993.1	G.vdsl	2004
ADSL2/2+	G.992.3/5 Amd 1/2	Amendment 1 (or "INP2") and Amendment 3 (or "INP3")	2005/6
Bonded DSL	G.998.1/2/3	G.bond	2005
VDSL2	G.993.2	G.vdsl2	2006
SELT	G.996.2	Single-ended DSL line testing	2009
VDSL2 Vectoring	G.993.5	G.vector	2010
Improved INP	G.998.4	ARQ or Physical Layer Retransmission or "PhyR" *	2010
G.FAST	G.9701	G.FAST	2014

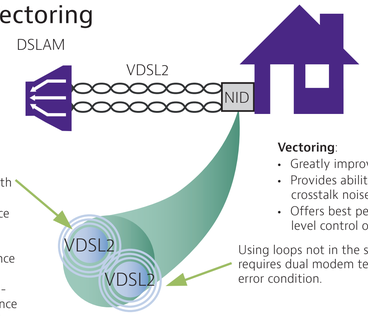
*NOTE: Broadcom proprietary impulse noise protection technology

Rate Reach



Compared to G-PON with a 32 split providing 78 Mbps to each subscriber, copper is a very cost-effective alternative out to more than 4000 ft (1200 m)

Bonding and Vectoring



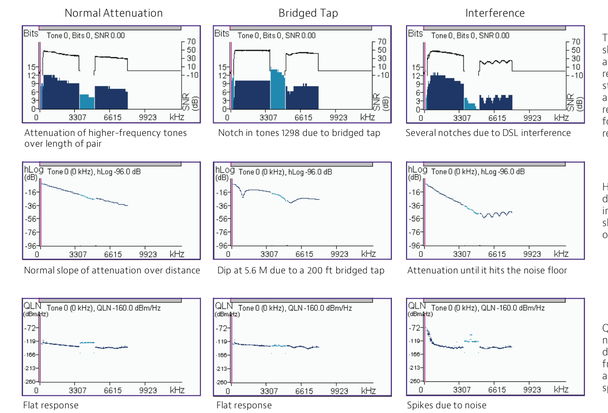
Dual Modem Emulation Testing Advantages:
- Enables crosstalk analysis with both pairs active
- View actual data performance with both loops/interfaces active
- Analyze full video performance with both loops active
- Accomplish trouble sectionalization where DSL performance is correlated to video packet performance.

Vectoring:
- Greatly improves performance
- Provides ability to cancel the effects of crosstalk noise
- Offers best performance where node level control of all lines is achieved

Using loops not in the same bonding group requires dual modem testing to identify this error condition.

Proper provisioning and bonded Group Metrics analysis require that both interfaces to be active.

BPT, Hlog, QLN



To learn more, visit viavisolutions.com

xdsl-po-tfs-tm-ae 30168472 900 0112