Acterna's Guide to "Find & Fix" in the Home

Preparing Subscribers for Advanced Services

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Parameter	FCC-Rule: 76.605USA	CENELEC-Rule: EN 50083-7 Europe
Minimum visual carrier level	0 dBmV at subscriber terminal 3 dBmV at end of 100 ft. drop cable connected to tap	60 dBuV at subscriber terminal (57 dBuV for systems with 8 MHz channel spacing only)
Visual carrier level 24 hour variation	Not vary more than 8 dB within 24 hrs and any six month interval (measured before the converter)	N.A.
Maximum signal level of adjacent channel	Within 3 dB of any visual carrier	Within 3 dB of any visual carrier
Minimum/maximum level delta visual carrier level	10 dB up to 300 MHz +1 dB for each additional 100 MHz of frequency bandwidth	12 dB from 47 to 862 MHz 6 dB for any 60 MHz range
Maximum visual carrier level	Is maximum level of subscriber terminal or receiver	80 dBuV at subscriber terminal (77 dBuV for systems with 8 MHz channel spacing only)
Sound carrier level	10 to 17 dB below the associated visual carrier level	11 to 18 dB below the associated visual carrier level
Digital TV carrier level	-10 dBmV at subscriber terminal -7 dBmV at end of 100 ft. drop cable connected to tap*	50 to 70 dBuV at subscriber terminal

(*not a FCC rule)

Limits for Proof-of-Performance

Know the measurement limits and the limits of your equipment! Quality of service is built in, not added. The FCC (US) and CENELEC (Europe) have provided rules to ensure sufficient quality of service to satisfy the communication needs of today's subscriber. To avoid mistakes, an analog/digital compatible signal level meter should test according to pre-selected limit sets. Make sure your instruments' limit sets are set to appropriate FCC and CENELEC standards and regulations.

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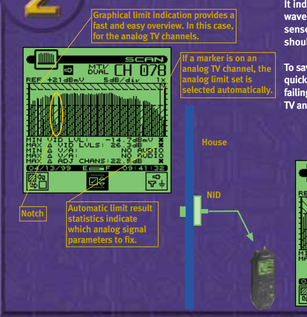

Be Prepared for Both Analog and Digital Signals

***First fix* problems before performing the final test**

A spectral-scan is the best tool to view trouble in one shot. It indicates frequency response, notches, roll-offs, standing waves, etc. It will also show if a final "auto test" makes sense. If signals are outside the limits already, the network should be fixed first, before performing any final testing.

To save time, a spectral scan with on-line limit check gives a quick real-time indication that the channel plan is passing or failing. Note: It must be easy to differentiate between analog TV and digital TV signals.

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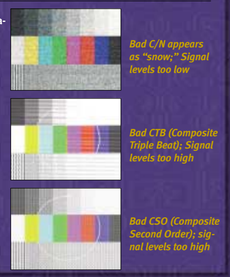
Carrier-to-Noise (C/N) Problems in the Home

When analog TV carrier levels are too low, they commonly create a "snowy" TV picture. Bad Carrier-to-Noise (C/N) is the result.

Intermodulation (CTB/CSO) problems

When carrier levels are too high, they commonly create intermodulation distortion products in home amplifiers or the input of the TV. Second and third order intermodulation products cause the bad TV pictures (see right).

Level measurement indicates:
- *Improper level setups*
- *Too much tap or cable loss*
- *Not enough amplifier gain*



Bad C/N appears as "snow;" Signal levels too low

Bad CTB (Composite Triple Beat); Signal levels too high

Bad CSO (Composite Second Order); signal levels too high

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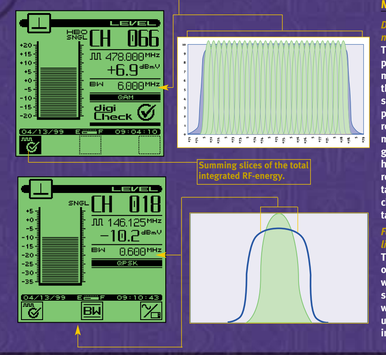

Making Accurate Digital Average Power and Performance Measurements

Digital-TV and forward cable modem signals

The digiCheck™ average-power measurement method takes small slices of the integrated RF-energy, summing them together to provide one total power reading. This method of measuring the total integrated RF-power under the haystack is very reliable, repeatable and accurate. It takes into account the in-channel flatness of the digital carrier itself.

Forward path digital signals like cable telephone carriers

The digiCheck™ feature offers a time average as well. This is mainly for small-band digital carriers, where a "scanning" measurement filter does not give incremental accuracy.

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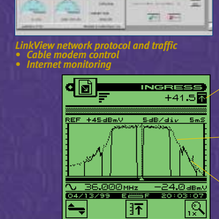
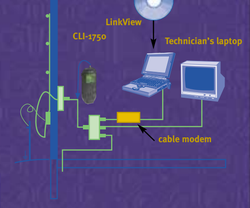
Making relative digital power measurements on reverse DOCSIS/EuroDOCSIS "bursty" cable modem signals with the CLI-1450/1750

The spectrum analyzer mode of the CLI-1750, in combination with peak-hold, makes it possible to capture the peak power of the "bursty" cable modem signal. After the peak-hold trace is built, a marker can be used to read the level in dBmV or dBuV. (Relative measurement only. No correction for occupied bandwidth.)

Specialized software (such as Acterna's LinkView) on a laptop makes control of the cable modem possible. This ensures that the proper cable modem is measured. At the same time this software can perform protocol analysis and check for double IP-addresses.



LinkView network protocol and traffic
- *Cable modem control*
- *Internet monitoring*



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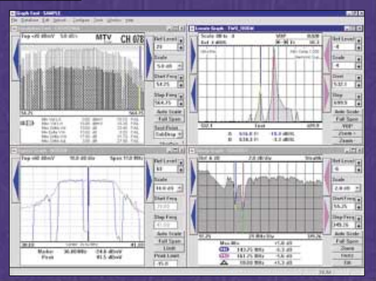
Manage Channel Plans, Setups, and View Signals Historically

With StealthWare, paperless management of all test results is possible. Report generation (according to the rules of FCC and CENELEC) can be performed and printed out. Maintaining setup and channel plans of all test equipment ensures repeatability.



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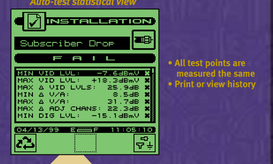
Automatic Measurements Save Time

To certify that the network termination and the home network are within specifications, an auto-test can be performed. Results can be viewed instantaneously. A statistical view indicates if there are any errors, the channel table view indicates which channels fail, and the detailed view indicates what the error is on that specific channel. These results can be printed out directly or downloaded into the PC for report generation.



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Verifying Frequency Response

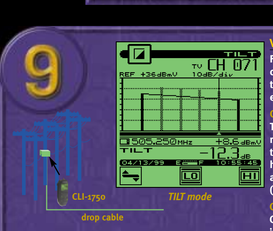
For digital and Internet services, check the frequency response. Two modes can be used: TILT (MicroStealth and CLI meters) and sweep (home wiring test kit). TILT measurement is a fast and effective method to balance line extenders and in-home amplifiers.

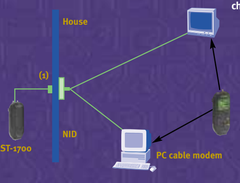
Checking for frequency response

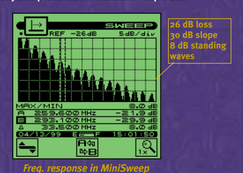
The "best" measurement and check of a signal path is with frequency response. It shows proper gain, too much loss, standing waves, parameters indicating problems with the cable, connectors, line extenders or in-house amplifiers, taps, splitters, and so forth. All relevant problems will appear in a response trace. It is recommended to sweep both directions (from groundblock to TV and TV to groundblock).

Connecting the Home Wiring Test Kit to sweep is easy

Connect the LST-1700 at the beginning (1) of the network. Put the LST-1700 in MiniSweep-mode. The CLI-1750 can now be connected at any test-point in the network. After selecting the MiniSweep-mode, the receiver will synchronize automatically and present a normalized sweep trace.







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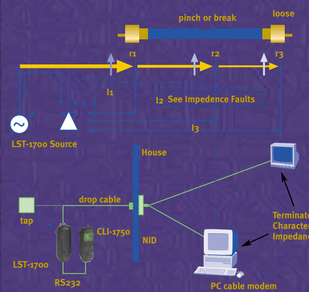
Find Physical Faults

If a cable fault is buried, inside a wall, or otherwise hidden, use the FDR mode of the CLI-1750. More accurate than TDR, the LST-1700 is used as a sweep generator, injecting a sweeping signal into the beginning of the network (street, home, apartment building). Bad cables, connectors, taps, splitters, etc. will cause reflections or standing waves. Analyzing these standing waves by the CLI-1750 gives a distance-to-fault diagram; reflection in dBrl vs. distance in feet or meters.



Cable Compensation

The displayed reflection includes the cable insertion loss. The Home Wiring Test Kit (HWTK) offers automatic cable loss compensation vs. frequency.

Advantages of FDR vs. TDR

Excellent event resolution - no "dead-zone". Higher dynamic range = farther distance. Measure through multiple taps, splitters, etc.

$$f(t) = \sum_{n=-\infty}^{\infty} Fn * e^{jn\omega t}$$

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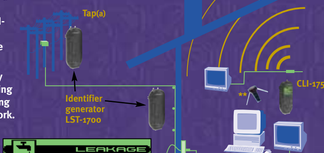
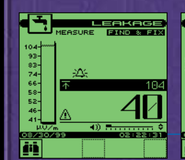
Proactive Leakage Detection in the Home

Leakage and ingress are directly coupled problems; a leak "out" can also be an "opening" for ingress to enter the system. Any time a tech is in a home and can take time to do a quick RF radiation measurement, he is also fixing "future" ingress problems. To find a leak, use the LST-1700 as a signal identifier. This ensures that the CLI-1750 leakage receiver is always detecting the known leaks from the network under investigation.

The LST-1700 should be temporarily connected to the tap(a) (the beginning of the drop cable) or to the beginning (ground block)(b) of the home network.





**The use of the hand-held dipole antenna (HD-1), reduces leakage troubleshooting time.

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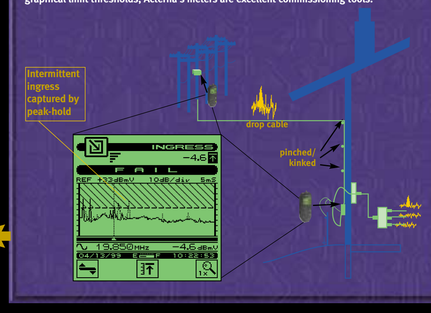
Measuring ingress: Proof-of-Performance for the reverse path

For the entire return path node, each home's noise and ingress combines and accumulates at the headend. It is therefore important to maintain "PoP", such as limits for each individual home under a certain ingress threshold. At the tap (the beginning of the drop cable) you can get the total ingress signature of that home. Moving the instrument toward the ingress source (deeper into the home) will eventually help you zoom in on the error. With graphical limit thresholds, Acterna's meters are excellent commissioning tools.



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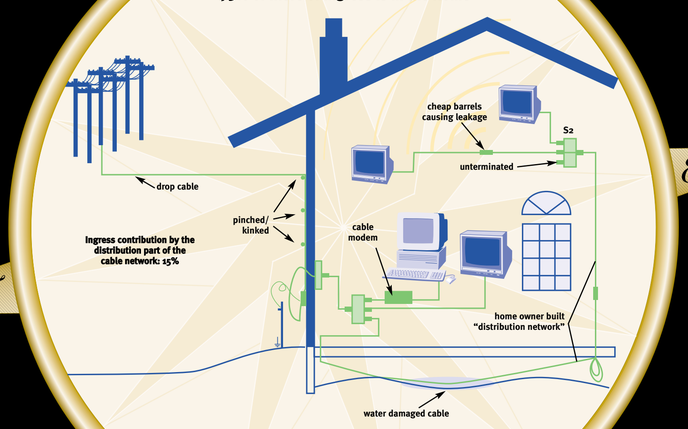
75% or More of Ingress is in the Home



Ingress is considered to be one of the biggest obstacles in deploying interactive services over the reverse part of the cable network. Most ingress originates from the distribution network in the home.

Cable Network Guide to “Find & Fix” in the Home

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