Importance of Level IV Tester for High Frequency Network Testing

As the cable industry moves toward Gigabit Ethernet networking applications, field testers need to support high frequency sweeps to meet test standards such as ISO-F 600 MHz or the emerging CAT6a to 625 MHz standard. At these higher frequencies, the test signals are closer to the limits of the cable standard, thereby, making the measurements less tolerant of the noise generated by the tester itself.

The baseline accuracy limits for field testers are specified to ensure that the intrinsic RF noise generated by the field tester will not effect the measurement of the cabling system in a negative fashion. Currently, all field testers performing CAT5e/6 and ISO-D/E measurements must meet Level III Accuracy.

Standards bodies now are working on a Level IV draft standard to improve the tester accuracy from Level III to Level IV as part of the Category 6a/7 and ISO Class F definitions. These required changes will have a significant impact to all field testers in the market place.

The impact of Level IV accuracy will have the following benefits for the industry:

1. Cable Certifiers that meet the proposed Level IV accuracy limits will be more precise with the internal noise of the tester thus minimize the impact to actual measurements.
2. With a Level IV accurate tester, installers can be certain that measurements will be extremely accurate at high sweep frequencies, meaning that installers will see the best margin possible.
3. Cable warranty managers will be more likely to extend warranties to systems that are certified by equipment that provides the most accurate measurements possible.

Level IV Increased Measurement Accuracy Requirements
There are two components to the LEVEL IV verification:
1) Baseline measurement accuracy
2) Permanent Link and Channel Link Measurement accuracy.
The Baseline measurement accuracy for any field tester is the fundamental, intrinsic measurement accuracy of that field tester with no additional measurement test fixtures attached to it. When moving the certification frequencies from 250 MHz for Level III, up to 600 MHz for Level IV, it required significant changes to the field tester Baseline measurement accuracy. These changes were to the specified random noise floor, residual NEXT and residual FEXT. These three parameters have the greatest impact upon the field tester's measurement accuracy as the field tester operating frequency range moved up to cover 1 to 600 MHz, to accommodate the Level IV, ISO Class F measurements.

Random Noise Floor Test Limit Comparison

The figure below shows how the random noise floor has been significantly lowered by the Level IV measurement accuracy requirements. The red Level IV random noise floor has been lowered to the level shown on this plot in order for the field tester to measure ISO Class F LAN links with increased accuracy, compared with the Level III random noise floor limit shown in blue.

This reduction in the field tester baseline random noise floor is required in order to prevent the internally generated random noise from the field tester to corrupt the LAN link measurements performed up to 600 MHz for the ISO Class F links.

Residual NEXT Test Limit Comparison
The figure shows how the residual NEXT limit has been significantly lowered by the Level IV measurement accuracy requirements. The red Level IV residual NEXT limit has been lowered to the level shown on this plot in order for the field tester to measure ISO Class F LAN links with increased accuracy, compared with the Level III residual NEXT limit shown in blue.

This reduction in the field tester baseline residual NEXT limit is required in order to prevent any internal crosstalk or NEXT within the field tester to prevent the field tester from measuring the significantly reduced LAN link NEXT values specified by the ISO Class F requirements.

Residual FEXT Test Limit Comparison
The figure on the following page shows how the residual FEXT limit has been significantly lowered by the Level IV measurement accuracy requirements. The red Level IV residual FEXT limit has been lowered to the level shown on this plot in order for the field tester to measure ISO Class F LAN links with increased accuracy, compared with the Level III residual FEXT limit shown in blue.

This reduction in the field tester baseline residual FEXT limit is required in order to prevent any internal crosstalk or FEXT within the field tester to prevent the field tester from measuring the significantly reduced LAN link FEXT values specified by the ISO Class F requirements.

Permanent Link and Channel Measurement Accuracy
While the Baseline Accuracy is an indication of how well the tester hardware performs in a standalone configuration, it does little to qualify how accurately the tester performs when measuring actual links. The raw data includes losses and reflections introduced by the interaction of the link with the tester and its adapters. With a more expensive laboratory instrument such as a Network Analyzer, these non-link losses can be calibrated out of the measurement by setting the “reference plane” at the boundaries of the Permanent Link of Channel. Using a Network Analyzer calibrated to NIST standards, measurement can be accurately taken. Then, using the Network Analyzer as a Transfer Standard, the test instruments data is compared to it and compared to the Draft Standard limits for accuracy. If the test instrument is accurate, its readings can only deviate from the Network Analyzer within the bounds specified by the Standard.

Source:

http://www.automation.com/library/articles-white-papers/instrumentation-test-measurement/importance-of-level-iv-tester-for-high-frequency-network-testing