Testing for a Category 6 Open Cabling System

While there are many challenges in specifying a category 6 cabling system, perhaps the most difficult is the interoperability between different category 6 component manufacturers. Unlike category 5 systems, where you can plug and play with your choice of connecting hardware and still feel confident that your system will perform as required, category 6 systems usually require a proprietary cabling system to achieve the promised results. To avoid being tied to one supplier, network owners and installers need to test and certify that their connecting hardware and patch cords are category 6 component compliant.

Cat 6 connector performance is key

In order to achieve a category 6 open cabling system that is not vendor specific, both the TIA and ISO define both the physical properties and electrical performance of the RJ45 plug. That's because the mated performance of the connector at the end of an installed cable is very dependent on the properties of the terminated RJ45 plug, especially the test parameter near-end-crosstalk (NEXT). As a result, connector manufacturers are required to design their connectors to a set of agreed physical properties for the RJ45 plug, while ensuring they will exceed the minimum electrical performance of NEXT for the mated connection. The minimum NEXT performance for a mated connection is 52.5 dB @ 100 MHz.

As vendors will inevitably start claiming true component compliance, it is important to understand the data they will use to prove their claims. The graph in *Figure 1* is a good example.

Start by looking at the axis along the bottom. It represents the de-embedded Plug NEXT @ 100 MHz in dB. The de-embedded plug can be seen as the value of cross-talk in the RJ45 test plug. The standards require the connector manufacturer to produce a series of laboratory test plugs that perform in the range 36.4 dB to 37.6 dB. These test plugs are then inserted into the manufacturer's connector one at a time and tested for NEXT. Different performing RJ45 test plugs will produce different mated results. The blue lines represent the range the test plugs must fall into which is 36.4 to 37.6 dB.

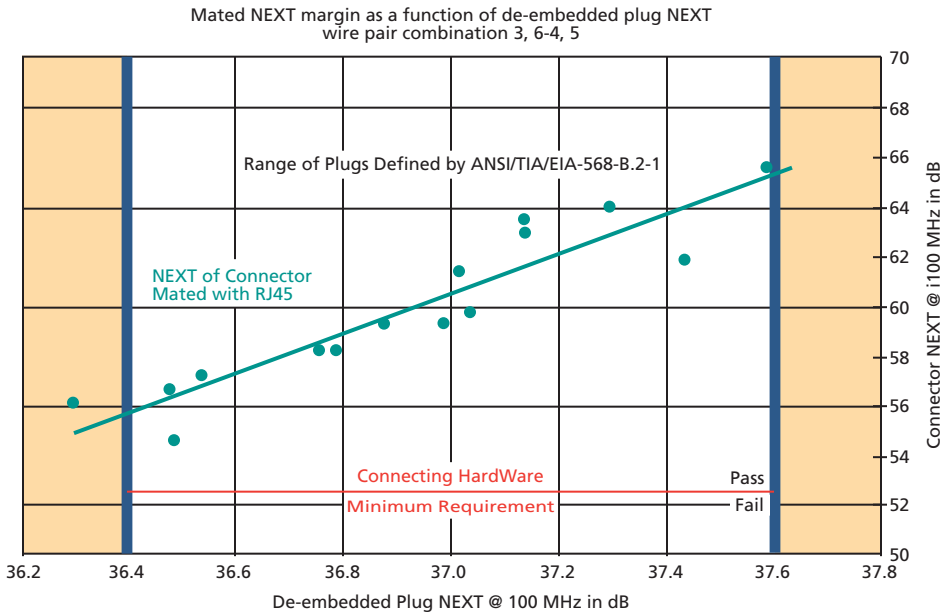

***Figure 1**. This graph represents how different performing test plugs (green dots) will produce different mated results for the pair combination 3,6-4,5.*

Plugs falling outside the blue line are ignored. The values are different for each pair combination. Given that 3,6-4,5 is normally the worst performing pair for NEXT, let's concentrate on this pair.

Fifteen measurements were made with a manufacturer's connector using 15 different de-embedded value test plugs. These are the green dots with a "best fit" line in green drawn through them. Fourteen of the test plugs fell within the defined required range. For this vendor, the news is good. The 14 test plugs, when inserted into the manufacturer's connector, exceed the minimum mated NEXT requirement of 52.5 dB @ 100 MHz. Therefore, this particular connector pair 3,6-4,5 is fully standards compliant. However, the graph reveals more information about this manufacturer's connector.

Note that with this specific connector, the mated performance improves with a higher value de-embedded test plug. If every connector performed at its best in the middle of the range (37 dB), then you could hot swap different patch cords with the minimum of penalty (or gain) in terms of overall link NEXT performance. While this is ideal, it is not the case with all vendors because each connector has its own unique trace. Some vendors' designs will perform better with a lower de-embedded test plug. So what does this mean for the installer testing category 6 links?

For the answer, refer to *Figure 2*. Here we show how the margin can change when certifying a Permanent Link using different valued de-embedded test plugs. For example, using a higher value de-embedded RJ45 test plug produces better overall link margin. The use of lower value de-embedded test plugs lowers the overall link margin. This explains why you get different results using different testers or test leads.

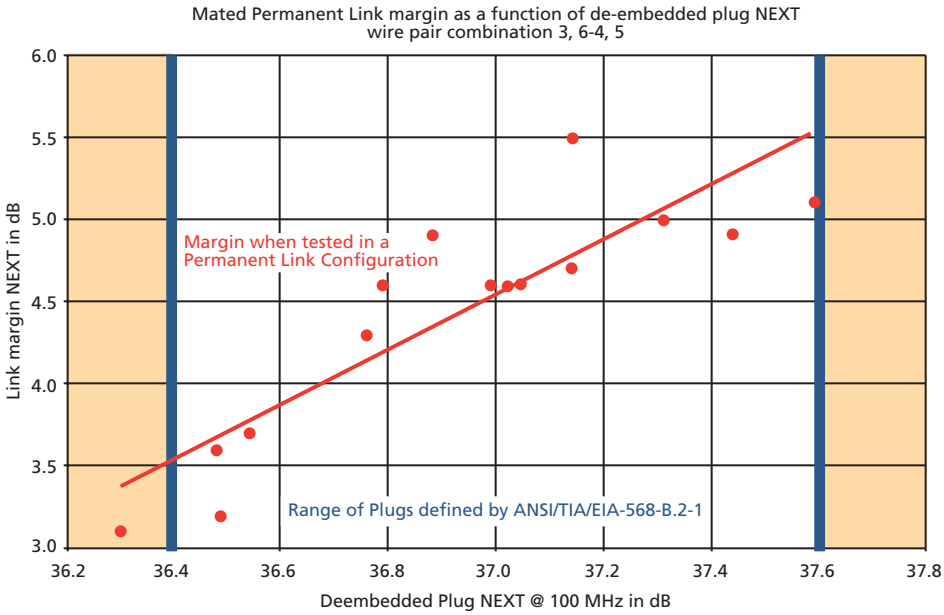

Figure 2 *- This graph represents how the margin can change when certifying the Permanent Link using different valued de-embedded test plugs on the same manufacturer's connector as in Figure 1.*

Even a fully compliant test lead can result in different margins for the installer. So why do test plugs vary in performance? This variation is caused by the manual termination of the RJ45 plug. There has to be a better solution to ensure consistent results.

New centered test plug design eliminates variability

In an effort to deliver more consistent test results, Fluke Networks has engineered the PM06 Personality Module, a new cable-free PCB-based test plug that delivers consistent results. The unique design of the PM06 fully complies with all plug specifications of the Cat 6 component standard, but is situated in the center (37 dB) of the performance ranges defined by the standards.

The PCB-based, centered design of Fluke Networks' PM06 test plug delivers consistent test results for certifying link as well as connecting hardware compliance to the Cat 6 standard.

This ***centered*** design ensures that all PM06 test plugs are, practically speaking, identical such that results will be optimal and show minimal variability. This consistency in test results allows you to compare the performance of different cabling solutions in a more reliable and predictable way.

Patch cord connector performance

Now that you know how to test connecting hardware for Cat 6 component compliance, how can you ensure the connector in the Cat 6 patch cords are standards compliant? Unfortunately, the majority of the patch cords on the market today that are labeled as category 6 fail to meet the minimum requirements of ANSI/TIA/EIA-568-B.2-1

and ISO/IEC 11801:2002. This problem is not widely reported because the test outlined in the standards requires the use of a laboratory grade network analyzer with special jacks that have been qualified to meet the TIA and IEC requirements (much like the de-embedded plugs mentioned earlier). It is an effective cord test, but not intended for field or high-volume testing. So the best method you could use was sample testing; not adequate for the very same reason Fluke Networks developed the DSP-PM06, since it's very difficult to control the terminations of patch cords, they must meet the same de-embedded properties as the test plug.

Patch cords have met their match

TIA specified the value of the jack to be used at each end of the patch cord test. Until now, there has been no viable field test solution that incorporates component compliant jacks into an adapter that could be attached to a field tester. This has also been achieved by Fluke Networks. The company offers new options for its DSP-4000 Series, including new hardware adapters designed specifically for patch cord testing and a special database containing the length dependent limit lines specified in ANSI/TIA/EIA-568-B.2-1 and ISO/IEC 11801:2002.

Using the DSP-PCI-6S Patch Cord Adapters is the only true way to ***certify*** patch cords. If you try to test patch cords using channel adapters, then your results won't be valid because the channel measurement requires the tester manufacturer to remove the effect of the connection to the tester. This explains why you are getting exceptional headroom figures when you just measured the patch cord with the channel adapters. The good news is that the new solution from Fluke Networks not only helps you certify patch cords, but it performs the test in 15 seconds, making 100% patch cord testing economically viable.

New category 6 testing tools benefit industry overall

The news of new category 6 testing tools and methodologies is good for the industry as a whole. Network owners and installers finally have absolute assurance that the connectors and patch cords they are using are standards compliant and will work with their new category 6 cabling system. Similarly, connector manufacturers, cable manufacturers, and the makers of quality patch cords now have the means to validate that their product is better than lower cost alternatives. The best way to ensure the quality of a category 6 open cable cabling system is to test each step of the way using Fluke Networks standards-compliant centered test plug and new DSP Patch Cord Test Adapters.

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