Application Note

Measuring the True Length of a Cable Pair with OneCheck and the UltraFED IIB

Signal attenuation (loss) increases with the length of a cable pair, leading to lower broadband rates. Therefore, measuring the true length of a cable pair is essential in assessing whether the pair can support broadband service. It is also a critical component of troubleshooting broadband service problems. For example, service on a pair that is within length limits but is marginal due to other fault conditions may be impaired while service on another pair of the same length does not. Similarly, a shorter pair with the same fault conditions may not experience issue. To effectively diagnose and correct problems, a technician must accurately measure and assess the impact of each parameter such as loop length, balance, and noise, both individually and as an aggregate. Failure to do so can result in confusion, wasted time, and misdiagnosis which in turn lead to higher failure rates and repeats.

A two-ended test provides accurate fault identification for wideband services

All too often, plant records are less than 100% accurate and cannot be relied upon to provide accurate loop length. There are several ways for a technician to determine pair length independent of plant records—and each method has its own strengths and limitations.

Test Challenge

Time Domain Reflectometer (TDR)

A TDR can be used to see the end of a cable. Depending on the cable length, the presence of fault conditions, and the technician skill level, assessing the pair length using a TDR can be simple and straightforward—or, somewhat challenging. One way to simplify the measurement is to use a far-end device like the VIAVI UltraFED™ IIB to repeatedly open and short the end of the pair while the TDR is running. This makes the end of the pair very easy to identify and removes all guesswork from the interpretation. The limitation of using a TDR exclusively is that the length is interpreted rather than directly measured. In other words, the TDR transmits a pulse and converts the time interval of reflected signals to distance based on the velocity of propagation (VP) of the signal. If the VP does not match the cable under test, the resulting distance will be less accurate. VP varies with cable gauge, so there is no selection of the proper VP in multi-gauge scenarios.

Open Meter

Telco cable is manufactured to a specified capacitance of .083 μF per mile. An open meter measures the capacitance of the pair to an open at the far-end and, knowing the specified capacitance of the cable, converts it to distance. Unlike a TDR or ohmmeter, an open measurement is not affected by cable gauge. The primary limitation of an open measurement is that instances of a bridged tap and water in the cable add capacitance and therefore make the open measurement appear longer than the true pair length.

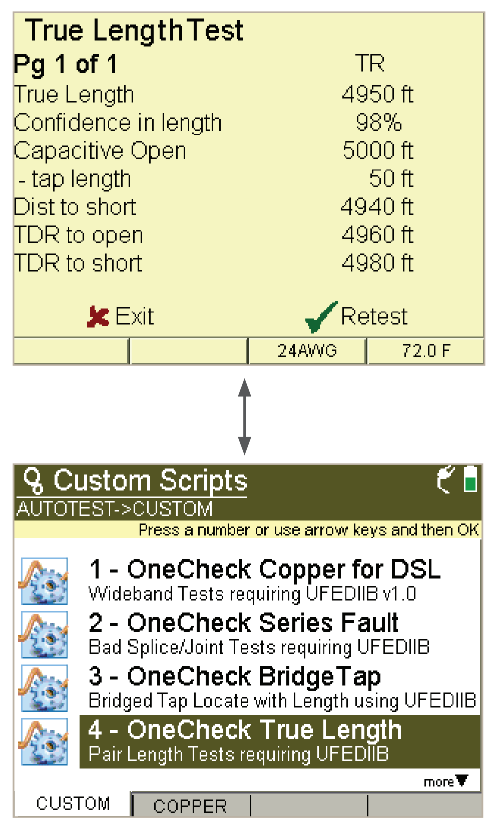
Ohmmeter

An ohmmeter determines the length of a cable pair by applying a known voltage and current to a loop that is shorted at the far end to first calculate the resistance. Resistance (R) is calculated using Ohm's law (R=E/I), dividing the ohmmeter source voltage (E) by the measured current (I). Cable resistance is typically .041 ohm per foot for 26-gauge cable at 68° F. Knowing this conversion, the resistance can be converted to distance. Unlike the OPENS measurement, the distance-to-short (resistive loop length) is not impacted by water in the cable or a bridged tap. However, cable resistance value can vary depending on several factors including temperature and cable gauge. A single customer line often has several splices and sometimes a mix of different cable gauges. The temperature of the pair temperature may vary: inside versus outside, buried versus

Addressing the Challenge with OneCheck and the UltraFED IIB

The True Length Automated Test

As discussed above, there are multiple methods for measuring loop length and each of these approaches has advantages and disadvantages. Best practice is to perform all three measurements, compare the results of each, and analyze the differences. Not only does this combined approach yield the most accurate assessment of loop length, but it paints a very useful picture (besides just length) of the pair itself. For example, if the loop lengths measured resistively (distance-to-short) and with the TDR are very close, but the open meter reads significantly longer, one might suspect the presence of a bridged tap or water in the cable and look for other indications of those problems. Historically, the largest drawback to using this combined approach is that performing all three measurements manually takes more time to set the proper conditions at the far end. Additionally, proper interpretation of the manual test results can be challenging for those who lack experience. The OneCheck True Length test, used with the UltraFED IIB, automates this entire test sequence with the press of a button, saving time and taking the guess work out of interpretation to provide the most accurate true cable length—one that a technician can use with confidence.



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