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TECHNICAL BULLETIN

The role of NVP in field-testing of balanced twisted-pair cabling insertion loss

Field-testing of an installed balanced twisted-pair cabling system is perhaps the final stage of a cabling infrastructure installation, prior to delivery to the client.

Despite the fact that telecommunications standards groups (e.g., ISO/IEC and TIA) have "harmonized virtually all transmission performance requirements, there is still one balanced twisted-pair transmission parameter, which is defined differently and tested differently per the ISO/IEC and TIA requirements. This parameter is insertion loss (IL) also known as attenuation.

The fundamental difference between TIA and IEC specifications and IL limit calculation methods lies in how the two standards define the maximum allowed length of the permanent link.

The ANSI/TIA-568-C.2 standard defines the IL limit as a constant (e.g., 90 m [295 ft]), while the ISO/IEC 11801 standard takes a more flexible approach to defining the length of components comprising the channel, allowing for an increase in the equipment cord/patch cord lengths beyond the customary 10 m (33 ft) at the cost of a proportional reduction in the length of the corresponding fixed cable. Due to this assumption, the permanent link length limit (i.e., fixed cable length) takes a variable form making the IL limit also dependent on the permanent link length.

When field-testing to the ANSI/TIA-568-C.2 specifications, the field tester should use the standard constant limit for each frequency test point (per ANSI/TIA-1152 requirements for testing procedures and field tester accuracy) within the frequency range of interest, without any reference to the length of the permanent link under test. On the other hand, when testing to the ISO/IEC 11801 specifications, it is absolutely necessary for the field tester to acquire the actual length value of the permanent link under test in order to calculate the corresponding IL limit. That is where the problem arises. What length should the tester use?

The only length of the object under test available to the field tester is the length it can measure. Since the tester can manipulate electrical transmission parameters only, the length can be measured based on the round trip time (i.e., delay) of the signal launched by the tester into the transmission line. In order to calculate the distance (e.g., length of the link) the signal travels, the tester should know the propagation time (also know as Propagation Delay, or PD, measured in nanoseconds) and the speed of the signal propagation in the given transmission media. The measurement method used to characterize PD is known as the Nominal Velocity of Propagation (NVP), which characterizes the speed of the signal in the balanced twisted-pair media relative to the speed of light in a vacuum.

NVP is a dimensionless parameter, usually expressed in two forms – decimal fraction (e.g., 0.72) or percentage (e.g., 72 %). Since the speed of light in a vacuum is the highest speed that can be achieved by an object of any nature, NVP values are always below 1 or 100 %, with values typical to common balanced twisted-pair cabling lying in the 0.6-0.8 (60%-80%) range.

Therefore, the field tester in order to test permanent link IL to the ISO/IEC 11801 specifications, must have the accurate NVP setting. An inaccurate NVP setting will result in inaccurate IL measurement results.

RECOMMENDATIONS:

1. Correct NVP setting is necessary when testing permanent link length per both TIA and IEC specifications. Inaccurate NVP settings result in inaccurate permanent link length measurements and recording.
2. Correct NVP setting is necessary when testing permanent link IL per IEC specifications. IL PASS/FAIL criteria is directly related to field tester length based on NVP accuracy. Inaccurate NVP settings result in inaccurate permanent link IL measurements and recording.
3. NVP value set in the field tester memory does not influence IL testing when testing per TIA specifications. Since calculations of the TIA IL limits do not involve NVP, accuracy of NVP setting cannot influence the resulting PASS/FAIL criteria of IL testing.