Comparing Copper Cable Certification Standards

Field testing of network cables is an important step in ensuring good quality of installation. Standards bodies across the world play a significant role in developing requirements for various electrical parameters to certify the cable against specific standards. There are several standardization bodies around the world. The good news is that most of them collaborate well with each other and define similar standards. However, there still are areas where these standardization bodies differ. If you are dealing with network infrastructure projects in multiple countries, knowing these differences is necessary.

There are three broad categories of standards that we should consider. First, networking standards defined by IEEE (802.3 series). The electrical parameters of the cabling must comply with the requirements of these standards. Second, cabling standards as specified by bodies such as TIA or ISO/IEC. These standards consider current and future networking technologies, cable construction technologies, installation practices, and operating environment while developing standards that cables, components, and cabling channels and links are specified for. Standards bodies also specify requirements for field testers, including how they should report test results, based on the cabling standards. In this article, we will look at cabling standards and corresponding field tester standards, and outline similarities and differences among TIA and ISO/IEC specifications.

Premise Cabling Standards

In most parts of the world, 4-pair twisted pair copper cabling follows either TIA-568.2-D or ISO/IEC 11801-1 specifications. There are other regional standards in some parts of the world (e.g. in China), which are strongly aligned with ISO/IEC standards. Table-1 shows a comparison of electrical parameters specified in TIA-568.2-D and ISO/IEC 11801-1.

Table 1 Cabling parameters and standards

Parameters	TIA-568.2-D	ISO/IEC 11801-1
Wiremap, DC loop resistance, DC resistance unbalance within two wires of a pair, DC resistance unbalance pair-to-pair, length, delay, delay skew, insertion loss, return loss, TCL, ELTCTL, coupling attenuation, NEXT, PSNEXT, ACRF, PSACRF, PSANEXT, PSAACRF	Specified	Specified
ACRN/PSACRN	Not specified	Specified

As you can see above all parameters other than ACRN/PSACRN are specified by both standards. ACRN (Attenuation to Near-End-Crosstalk Ratio) is specified only in the ISO/IEC standard. As ACRN is derived from insertion loss (attenuation) and NEXT, which are specified parameters for the TIA standard, this difference is non-material in nature.

Other Cabling Standards

Industrial Cabling

TIA-1005-A is an industrial cabling standard that specifies parameters like those listed in Table-1 above except for DC resistance. This standard specifies TCL and ELTCTL only for unshielded cables.

Single Pair Ethernet

Single Pair Ethernet (SPE) is an emerging technology for cabling in many different environments ranging from automotive to industrial to enterprise. TIA-568.5 standard specifies SPE cabling for enterprise environments. Performance parameters specified in TIA-568.5 are listed in Table-2.

Table 2 SPE parameters

Parameters	TIA-568.5	ISO/IEC 11801-1/AMD1 (draft)
Wiremap, DC loop resistance, DC resistance unbalance within two wires of a pair, length, delay, insertion loss, return loss, PSANEXT, PSAACRF	Specified	Specified
TCL, ELTCTL	Specified for UTP only	Specified for UTP only

Field Testing Standards

TIA-1152A and IEC 61935-1 are standards that specify the performance requirements for field testers. They also specify test parameters that need to be reported, reporting format and classify reporting parameters as either mandatory or optional.

Table 3 Field Test Parameters

Parameters	TIA-568.2-D	ISO/IEC 11801-1
Wiremap including shield connection if present, length, delay, delay skew, insertion loss, return loss, coupling attenuation, NEXT, PSNEXT, ACRF, PSACRF, PSANEXT, PSAACRF	Specified, mandatory	Specified, mandatory
ACRN/PSACRN	Not specified	Specified, mandatory
DC loop resistance	Specified, optional	Specified, mandatory
DC resistance unbalance within two wires of a pair, DC resistance unbalance pair-to-pair	Specified, optional	Specified, optional
Length	Specified	Not specified
TCL, ELTCTL	Not specified	Specified, optional
Coupling attenuation	Not specified	Not specified

Table-3 specifies field test parameters for 4-pair cabling certification testers. Please note that it is not necessary that every certification test report all the mandatory parameters. The table lists the capability of the tester, which gets utilized depending on the parameters required for a chosen certification test. Between the TIA and ISO versions of these requirements, there are some differences. DC loop resistance, and unbalance in resistance, are important parameters for PoE. Even if they are marked optional, these measurements provide important assurance of PoE performance. Coupling attenuation is a parameter that provides insight on shield effectiveness for shielded cables. This measurement is a laboratory measurement and ensured by the design of the cables, and hence field testers are not required to support this.

SPE Field Testing

TIA-5071 specifies field tester requirements based on the TIA-568.5 standard.

Table 4 SPE Field test parameters

Parameters	TIA-5071	IEC 61935-4 (draft)
Wiremap including shield connection if present, DC loop resistance, length, delay, insertion loss, return loss, coupling attenuation, TCL (unshielded), ELTCTL (unshielded), PSANEXT, PSAACRF	Specified, mandatory	Specified, mandatory
DC resistance unbalance (shielded)	Specified, mandatory	Specified, optional
Coupling attenuation	Not specified	Specified, optional

In addition to the parameters as listed in Table-4, the two standards also specify testing to different lengths and frequencies as shown in Table-5. This allows a possibility to have field testers that only support one of the specified categories. However, in practice commercial field testers support all these categories.

Table 5 Frequency Ranges and Field Tester categories

Frequency Range	TIA-5071	IEC 61935-4 (draft)
0.1-20 MHz	SP-I	SP-I
0.1-600 MHz	SP-II	SP-II
1-1250 MHz	-	SP-III

Summary

Standards bodies play an important role in formalizing the requirements for cabling, their test parameters, testing methodologies, and reporting. TIA and international standards are largely similar, with some differences originating from the applications targeted, and range of cabling systems covered.