

LAN cable standards

Overview of IEC, TIA and YD/T requirements

INTRODUCTION

The requirements for twisted pair communication cables are defined in several standards. They define categories with different levels of performance in signal bandwidth, insertion loss (or attenuation), and crosstalk. Generally increasing category numbers correspond to a cable system capable of higher data transmission rates.

For instance, Category 3 cable was suitable for telephone circuits with data rates up to 16 Mbit/s (million bits per second). Today, current standards include Category 5e (100 MHz, up to 1Gbit/s) up to Category 8 (2 GHz, up to 40Gbit/s).

Actually there are three major standard associations who publish standards depending on the region:

- Major part of the world:
 - IEC (International Electrotechnical Commission)
 - IEC 61156-5/-6 (Cat5e – Cat7_A)
 - IEC 61156-9/-10 (Cat8.1 (F/UTP type) and Cat8.2(S/FTP type))
- North America:
 - TIA (Telecommunications Industry Association)
 - TIA 568-C.2 (Cat5e – Cat6A)
 - TIA 568-C.2-1 (Cat8)
- China:
 - YD/T (China Communication Standard Association)
 - YD/T 838.2-2016 (Cat5e – Cat 7A)

The relevant requirements are separated into 2 separate groups as follows:

1. Electrical characteristics and tests
2. Transmission characteristics

1. Electrical characteristics and tests

Defined in all standards: requirements are not always similar but do exist.

Though, there are some specialties for Transfer Impedance and Coupling Attenuation as highlighted in tables of Section 2.

Parameter	Covered by:
Conductor Resistance	AESA low frequency option for our ATE
Resistance Unbalance	AESA low frequency option for our ATE
Dielectric Strength	AESA Gaia
Insulation Resistance	AESA Gaia
Mutual Capacitance	AESA low frequency option for our ATE
Capacitance Unbalance	AESA low frequency option for our ATE
Transfer Impedance*	CoMeT option, only for screened cables applicable
Coupling Attenuation**	CoMeT option for screened cables, Absorbing clamps for unscreened cables

*: Transfer Impedance tested up to 100MHz not depending on the category

** : Coupling Attenuation always tested from 30MHz up to 1000MHz for IEC(up to Cat7_A); TIA only for screened cables and up to the maximum frequency of the category(e.g. for Cat 6A → 500MHz); Coupling Attenuation is required for all Cat8 standards

2. Transmission characteristics

Explanation:

For all cable types	
For screened cables only	
For unscreened cables only	
No requirements	

Table 1: Parameters according to IEC standards

Parameter	Cat5e	Cat6	Cat6 _A	Cat7	Cat7 _A	Cat8.1/Cat 8.2
Frequency range	1-100MHz	1-250MHz	1-500MHz	1-600MHz	1-1000MHz	1-2000MHz
Velocity of propagation						
Phase delay, delay skew						
Attenuation						
Unbalance Attenuation (TCL, ELTCTL)						
Near-End Crosstalk (NEXT)						
Far-End Crosstalk (FEXT)						
Alien Near-End Crosstalk (ANEXT)					*	**
Alien Far-End Crosstalk (AFEXT)					*	**
Impedance						
Return Loss						
Transfer Impedance (TI)						
Coupling Attenuation (AC)						
AESA ATE correspondence	Phoenix 4 DT/ Vega/ Vega DT 754	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 1204 Cobalt/ Cobalt DT	Vega/ Vega DT 2004 Cobalt/ Cobalt DT

 *: Requirements for Cat7_A cables given but exclusion rule defines it as not required

**: Exclusion rule: Only if less than type 1b on coupling attenuation testing is required, excludes in fact Cat 8.2 but only some/few of Cat 8.1 cables (uncertain as not yet seen on the market)

Table 2: Parameters according to TIA standards

Parameter	Cat5e	Cat6	Cat6 _A	Cat7	Cat7 _A	Cat8
Frequency range	1-100MHz	1-250MHz	1-500MHz	Not existing	Not existing	1-2000MHz
Velocity of propagation						
Phase delay, delay skew						
Attenuation						
Unbalance Attenuation (TCL, ELTCTL)						
Near-End Crosstalk (NEXT)						
Far-End Crosstalk (FEXT)						
Alien Near-End Crosstalk (ANEXT)						
Alien Far-End Crosstalk (AFEXT)						
Impedance						
Return Loss						

Transfer Impedance (TI)						
Coupling Attenuation (AC)						
AESA ATE correspondence	Phoenix 4 DT/ Vega/ Vega DT 754	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 1204 Cobalt/ Cobalt DT	Vega/ Vega DT 2004 Cobalt/ Cobalt DT

Table 3: Parameters according YD/T 838.2-2016

Parameter	Cat5e	Cat6	Cat6 _A	Cat7	Cat7 _A	Cat8	
Frequency range	1-100MHz	1-250MHz	1-500MHz	1-600MHz	1-1000MHz	1-2000MHz	
Velocity of propagation						Not defined yet or under consideration	
Phase delay, delay skew							
Attenuation							
Unbalance Attenuation (TCL, ELTCTL)							
Near-End Crosstalk (NEXT)							
Far-End Crosstalk (FEXT)							
Alien Near-End Crosstalk (ANEXT)					*		
Alien Far-End Crosstalk (AFEXT)					*		
Impedance							
Return Loss							
Transfer Impedance (TI)							
Coupling attenuation (AC)							
AESA ATE correspondence	Phoenix 4 DT/ Vega/ Vega DT 754	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 754 Cobalt/ Cobalt DT	Vega/ Vega DT 1204 Cobalt/ Cobalt DT		Vega/ Vega DT 2004 Cobalt/ Cobalt DT

*: Requirements for Cat7_A cables given but exclusion rule defines it as not required

List of available options for the above tables:

	TCL, ELTCTL	Alien crosstalk	TI, Coupling Attenuation (AC)
Phoenix DT	Option	Semiautomatic; 2 Versions available: Up to Cat6 _A (unscreened only) Up to Cat8 (all types) Or: Vega 7528(only Cat6 _A)	CoMeT40 for LAN-cables CoMeT90 for power cables Smaller/ larger diameters on request
Vega/ Vega DT	Option		
Cobalt/ Cobalt DT	Included		

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