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AMENDMENT 1

Information technology - Generic cabling for customer premises - Part 1: General requirements

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AMENDMENT 1

FOREWORD

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Amendment 1 to ISO/IEC 11801-1:2017 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The text of this Amendment is based on the following documents:

Draft	Report on voting
JTC1-SC25/3285/CDV	JTC1-SC25/3337A/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, and the ISO/IEC Directives, JTC 1 Supplement available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

INTRODUCTION TO THE AMENDMENT

This document specifies single pair component Categories T1-A, T1-B, and T1-C, as well as cabling channels and link Classes T1-A, T1-B, and T1-C to support single pair applications. Balanced single pair channels and links specified in this document are not a replacement for the generic 4-pair channels in ISO/IEC 11801-1:2017. They are an additional media type intended for use in intelligent building and industrial automation devices (e.g. in network sensors, actuators, and controllers). Because of the different types and locations of these devices, single pair cabling will have distinct structures and distribution architectures that are detailed in other parts of the ISO/IEC 11801 series.

This document also provides modifications and corrections to ISO/IEC 11801-1:2017.

INTRODUCTION

Replace the existing Figure 1 with the following new figure:

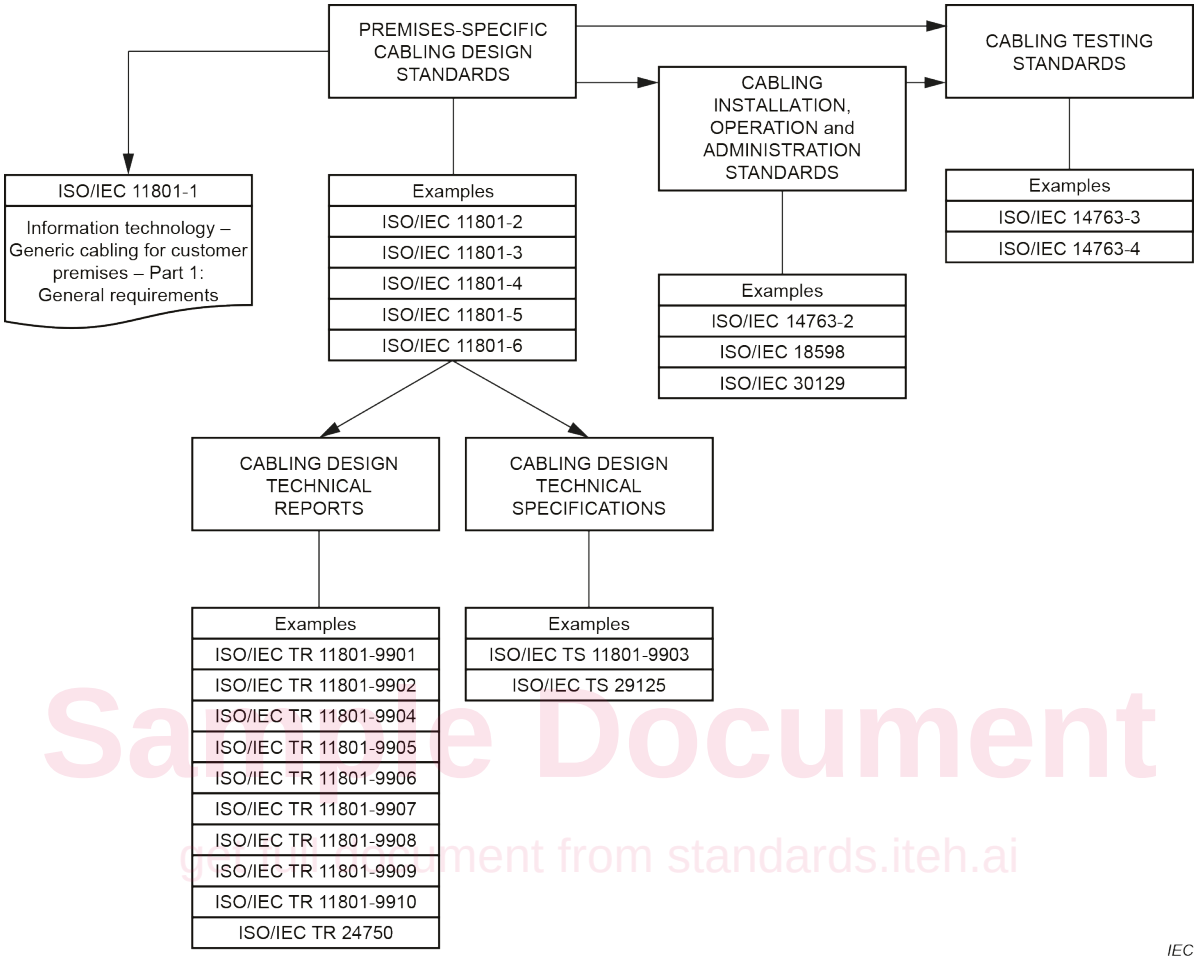

Figure 1 – Relationships between the generic cabling documents produced by ISO/IEC JTC 1/SC 25

1 Scope

Replace existing bullet b) with the following:

b) channel transmission, environmental and power delivery performance requirements;

2 Normative references

Add the following normative references at the end of the list:

IEC 60512-99-002, *Connectors for electrical and electronic equipment - Tests and measurements - Part 99-002: Endurance test schedules - Test 99b: Test schedule for unmating under electrical load*

IEC 61156-11, *Multicore and symmetrical pair/quad cables for digital communications - Part 11: Symmetrical single pair cables with transmission characteristics up to 1,25 GHz - Horizontal floor wiring - Sectional specification*

IEC 61156-12, *Multicore and symmetrical pair/quad cables for digital communications - Part 12: Symmetrical single pair cables with transmission characteristics up to 1,25 GHz - Work area wiring - Sectional specification*

IEC 61156-13, *Multicore and symmetrical pair/quad cables for digital communications - Part 13: Symmetrical single pair cables with transmission characteristics up to 20 MHz - Horizontal floor wiring - Sectional specification*

IEC 61156-14, *Multicore and symmetrical pair/quad cables for digital communications - Part 14: Symmetrical single pair cables with transmission characteristics up to 20 MHz - Work area wiring - Sectional specification*

IEC 61196-1-105, *Coaxial communication cables - Part 1-105: Electrical test methods - Test for withstand voltage of cable dielectric*

IEC 61935-4, *Specification for the testing of balanced and coaxial information technology cabling - Part 4: Installed balanced single-pair cabling as specified in ISO/IEC 11801-1 and related standards*[1]

IEC 63171, *Connectors for electrical and electronic equipment - Shielded or unshielded free and fixed connectors for balanced single-pair data transmission with current-carrying capacity - General requirements and tests*

IEC 63171-1, *Connectors for electronic equipment - Part 1: Detail specification for two-way, shielded or unshielded, free and fixed connectors - Mechanical mating information, pin assignment and additional requirements for Type 1 copper LC style*

IEC 63171-6, *Connectors for electrical and electronic equipment - Part 6: Detail specification for 2-way and 4-way (data/power), shielded, free and fixed connectors for power and data transmission with frequencies up to 600 MHz*

ISO/IEC TS 29125, *Telecommunications cabling requirements for remote powering of terminal equipment*

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[1] First edition under preparation. Stage at the time of publication: IEC CDV 61935-4:2025.

3.2 Abbreviations

Add the following new abbreviations at the end of the list:

PON passive optical network
S-PoE single pair Power over Ethernet
SP single pair
SPE single pair Ethernet

5.3.1 Cabling subsystem 1

Replace the last paragraph with the following paragraph:

Although terminal equipment cords and equipment cords are used to connect terminal and transmission equipment respectively to the cabling subsystem, they are not considered part of the cabling subsystem because they can be application specific.

6 Channel performance requirements

6.3.3.4.1 General

Delete the existing second paragraph.

6.3.3.6 Direct current loop resistance

Replace the existing Table 17 with the following new Table 17:

Table 17 – DC loop resistance for a channel

DC loop resistance [a]		
Class	**Maximum DC loop resistance at 60 °C [b]** Ω	**Informative DC loop resistance at 20 °C [b]** Ω
A	560	472
B	170	143,3
C	40	33,7
D, E, E_A, F, F_A	25 [c]	21,1 [e]
BCT-B-L	4,0	3,4
BCT-B-M	6,9	5,8
I, II	6,4 [d]	5,4 [f]

[a] This requirement is based on channels designed for the MICE C1 environmental classification.

[b] The requirements at 20 °C and 60 °C are equivalent according to the generic formula for temperature correction of resistance. To correct DC loop resistance to a different temperature, the conversion is as follows:

$$R = R_{\text{ref}}\left[1 + \alpha\left(T - T_{\text{ref}}\right)\right]$$

where

R is conductor resistance at temperature T in Ω;

R_{ref} is conductor resistance at reference temperature T_{ref}, usually 20 °C, in Ω;

α is temperature coefficient of resistance for the conductor material (copper = 0,003 93) per °C;

T is conductor temperature in °C;

T_{ref} is reference temperature that α is specified at for the conductor material in °C.

[c] The maximum DC loop resistance at 60 °C of each pair of a cable (excluding connections) within a 2-connector link used in a channel shall be 0,22 Ω/m. This shall be achieved by an appropriate design.

[d] The maximum DC loop resistance at 60 °C of each pair of a cable (excluding connections) within a 2-connector link used in a channel shall be 0,16 Ω/m. This shall be achieved by an appropriate design.

[e] The maximum DC loop resistance at 20 °C of each pair of a cable (excluding connections) within a 2-connector link used in a channel shall be 0,19 Ω/m. This shall be achieved by an appropriate design.

[f] The maximum DC loop resistance at 20 °C of each pair of a cable (excluding connections) within a 2-connector link used in a channel shall be 0,14 Ω/m. This shall be achieved by an appropriate design.

6.3.3.12.2 Unbalance attenuation, near-end

Replace the existing Table 22 with the following new Table 22:

Table 22 – Informative TCL values for unscreened channels at key frequencies

Minimum TCL dB									
Frequency MHz	**Class**								
	A	**B**	**C**	**D**			**E, E_A**		
	E_1, E_2, E_3	**E_1, E_2, E_3**	**E_1, E_2, E_3**	**E_1**	**E_2**	**E_3**	**E_1**	**E_2**	**E_3**
0,1	30,0	40,0	–	–	–	–	–	–	–
1	–	20,0	30,0	40,0	40,0	40,0	40,0	40,0	40,0
16	–	–	24,0	34,9	40,0	40,0	34,9	40,0	40,0
30	–	–	–	30,8	40,0	40,0	30,8	40,0	40,0
100	–	–	–	20,3	30,3	40,0	20,3	30,3	40,0
250	–	–	–	–	–	–	12,3	22,3	32,3
NOTE E_1, E_2 and E_3 relate to the MICE environmental classification.									

6.3.3.12.4 Coupling attenuation

Add the following sentence after the first sentence of the second paragraph:

The coupling attenuation of each pair of a channel, with maximum implementation, at key frequencies is given in Table 145 for information only.

Add the following new table below the existing Table 29:

Table 145 – Informative coupling attenuation values for a screened channel at key frequencies

Minimum coupling attenuation dB									
Frequency MHz	Class								
	D, E, E_A, F, F_A [a]			BCT-B			I, II		
	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
30	40,0	50,0	60,0	85,0	85,0	85,0	50,0	50,0	60,0
100	40,0	50,0	60,0	85,0	85,0	85,0	50,0	50,0	60,0
250	32,0	42,0	52,0	85,0	85,0	85,0	42,0	42,0	52,0
500	26,0	36,0	46,0	75,0	75,0	75,0	36,0	36,0	46,0
1 000	20,0	30,0	40,0	75,0	75,0	75,0	30,0	30,0	40,0
1 600	–	–	–	–	–	–	25,9	25,9	35,9
2 000	–	–	–	–	–	–	24,0	24,0	34,0

NOTE E_1, E_2 and E_3 relate to the MICE environmental classification.

[a] The informative values are applicable to the upper frequency of the Class.

6.3.3.13.6 Alien crosstalk and coupling attenuation for screened channels

Replace the existing Table 38 with the following new Table 38:

Table 38 – Alien crosstalk and coupling attenuation for screened channels

Class	Frequency MHz	Minimum coupling attenuation to meet PS ANEXT limits dB	Minimum coupling attenuation to meet PS AACR-F limits dB
E_A	$30 \le f < 100$	50	50
	$100 \le f \le 500$	$90 - 20\lg(f)$	$90 - 20\lg(f)$
F	$30 \le f < 100$	50	50
	$100 \le f \le 600$	$90 - 20\lg(f)$	$90 - 20\lg(f)$
F_A	$30 \le f < 100$	65	65
	$100 \le f \le 1000$	$105 - 20\lg(f)$	$105 - 20\lg(f)$
I	$30 \le f < 100$	65	65
	$100 \le f \le 2000$	$105 - 20\lg(f)$	$105 - 20\lg(f)$
II	$30 \le f < 100$	65	65
	$100 \le f \le 2000$	$105 - 20\lg(f)$	$105 - 20\lg(f)$

6.5.2.1 Channel attenuation

Replace the first paragraph with the following:

For the purpose of specifying channel limits, the cable requirements of Table 92 and the connecting hardware requirements of Table 136 shall be used.

Insert new subclause:

6.6 Single pair cabling transmission performance

6.6.1 General

This document specifies the following Classes for single pair balanced cabling:

a) Class T1-A is specified from 0,1 MHz to 20 MHz,

b) Class T1-B is specified from 0,1 MHz to 600 MHz,

c) Class T1-C is specified from 0,1 MHz to 1 250 MHz.

The insertion loss, *PS AACR-F*, *ELTCTL* and other length related parameter performance of Class T1-A cabling is further subdivided into three sub-Classes, T1-A-100, T1-A-400, and T1-A-1000. These sub-Classes have identical performance requirements for all other transmission parameters. The numerical identifiers at the end of the T1-A sub-Classes refer to the assumptions of maximum channel length from the reference implementation for data transmission.

A Class T1-A channel is specified so that it will provide the minimum transmission performance to support Class T1-A applications. Channels of a given Class will support all applications of a lower Class with the same length. For example, a 100 m Class T1-B channel is backward compatible to a 100 m Class T1-A channel. Annex E lists known single pair balanced cabling applications by Class. Annex G lists possible channel length reductions required when remote powering is applied. Additional information related to cable heating, installation environments and cable bundling is given in ISO/IEC TS 29125.

The requirements in 6.6 are given by limits computed to one decimal place, using the equation for a defined frequency range. The limits for the propagation delay and delay skew are computed to three decimal places. The informative tables show the calculated values derived from the relevant equation at key frequencies. Many specifications in 6.6 have a plateau in the specified requirement. These plateaus do not accurately depict the system performance. They have been added for measurement purposes.

6.6.2 Component choice

The parameters specified in 6.6 apply to channels with screened or unscreened cable elements unless explicitly stated otherwise.

The nominal differential mode impedance of channels is 100 Ω. This is achieved by suitable design and appropriate choice of cabling components (irrespective of their nominal impedance).

6.6.3 Channel parameters

6.6.3.1 Return loss

The return loss requirements are applicable to all single pair cabling Classes.

The return loss (*RL*) of a single pair channel shall meet the requirements in Table 146. The *RL* values for a single pair channel at key frequencies are given in Table 147 for information only.

The return loss requirements shall be met at both ends of the cabling. Return loss (*RL*) values at frequencies where the insertion loss (*IL*) is below 3,0 dB are for information only.

Table 146 – Return loss for a single pair channel

Class	Frequency MHz	Minimum return loss dB
T1-A	0,1 ≤ f < 0,5	9 + 8 (f)
	0,5 ≤ f ≤ 20	13,0
T1-B	0,1 ≤ f < 1	9 + 10 (f)
	1 ≤ f < 10	19,0
	10 ≤ f < 40	24 − 5 lg(f)
	40 ≤ f < 130	16,0
	130 ≤ f < 400	37 − 10 lg(f)
	400 ≤ f ≤ 600	11,0
T1-C	0,1 ≤ f < 1	9 + 10 (f)
	1 ≤ f < 10	19,0
	10 ≤ f < 40	24 − 5 lg(f)
	40 ≤ f < 130	16,0
	130 ≤ f < 400	37 − 10 lg(f)
	400 ≤ f < 600	11,0
	600 ≤ f ≤ 1 250	38,8 − 10 lg(f)

Table 147 – Informative return loss values for a single pair channel at key frequencies

Frequency MHz	Minimum return loss dB		
	Class		
	T1-A	T1-B	T1-C
0,1	9,8	10,0	10,0
1	13,0	19,0	19,0
20	13,0	17,5	17,5
100	–	16,0	16,0
250	–	13,0	13,0
500	–	11,0	11,0
600	–	11,0	11,0
1 000	–	–	8,8
1 250	–	–	7,8

6.6.3.2 Insertion loss

The insertion loss requirements are applicable to all single pair cabling Classes.

The insertion loss (*IL*) of a single pair channel shall meet the requirements in Table 148. The insertion loss values for a single pair channel at key frequencies are given in Table 149 for information only.

Table 148 – Insertion loss for a single pair channel

Class	Frequency MHz	Maximum insertion loss [a] dB
T1-A-1000 [b]	$0,1 \le f \le 20$	$10 \times \left(1,23\sqrt{f} + 0,01 \times f + \frac{0,2}{\sqrt{f}}\right) + 10 \times 0,02\sqrt{f}$
T1-A-400 [c]	$0,1 \le f \le 20$	$4,05 \times \left(1,82\sqrt{f} + 0,0091 \times f + \frac{0,25}{\sqrt{f}}\right) + 5 \times 0,02\sqrt{f}$
T1-A-100 [c]	$0,1 \le f \le 20$	$1,05 \times \left(1,82\sqrt{f} + 0,0091 \times f + \frac{0,25}{\sqrt{f}}\right) + 4 \times 0,02\sqrt{f}$
T1-B [c]	$0,1 \le f \le 600$	$1,05 \times \left(1,8\sqrt{f} + 0,005 \times f + \frac{0,25}{\sqrt{f}}\right) + 4 \times 0,02\sqrt{f}$
T1-C [c]	$0,1 \le f \le 1\,250$	$1,05 \times \left(1,8\sqrt{f} + 0,005 \times f + \frac{0,25}{\sqrt{f}}\right) + 4 \times 0,02\sqrt{f}$

[a] Insertion loss (*IL*) at frequencies that correspond to calculated values of less than 3,0 dB shall revert to a requirement of 3,0 dB.

[b] Cord cable used in the channel is expected to have no de-rating based on construction.

[c] 10 m of 50 % de-rated (based on construction) cord cable is assumed in the equation.

Table 149 – Informative insertion loss values for a single pair channel at key frequencies

Frequency MHz	Maximum insertion loss dB				
	Class				
	T1-A-1000	T1-A-400	T1-A-100	T1-B	T1-C
0,1	10,3	5,6	3,0	3,0	3,0
1	14,6	8.5	3,0	3,0	3,0
20	58,3	34,4	9,2	9,0	9,0
100	–	–	–	20,3	20,3
250	–	–	–	32,5	32,5
500	–	–	–	46,7	46,7
600	–	–	–	51,4	51,4
1 000	–	–	–	–	67,6
1 250	–	–	–	–	76,2

6.6.3.3 Direct current (DC) loop resistance

The DC loop resistance requirements are applicable to all single pair cabling Classes.

The DC loop resistance of a single pair channel shall meet the requirements in Table 150.

Table 150 – Direct current (DC) loop resistance for a single pair channel at 20 °C

DC loop resistance [a]	
Class	**Maximum DC loop resistance at 20 °C [d]** Ω
T1-A-1000 [b]	47,0
T1-A-400 [c]	58,5
T1-A-100 [c]	14,9
T1-B [c]	14,9
T1-C [c]	14,9

[a] This requirement is based on channels designed for the MICE C1 environmental classification.

[b] The maximum DC loop resistance at 20 °C of the cable pair (excluding connections) within a link, used in a channel shall be 0,046 Ω/m. This shall be achieved by an appropriate design.

[c] The maximum DC loop resistance at 20 °C of the cable pair (excluding connections) within a link, used in a channel shall be 0,145 Ω/m. This shall be achieved by an appropriate design.

[d] To correct DC loop resistance to a different temperature, the conversion is as follows:

$$R = R_{\text{ref}}\left[1 + \alpha\left(T - T_{\text{ref}}\right)\right]$$

where

R is conductor resistance at temperature T in Ω;

R_{ref} is conductor resistance at reference temperature T_{ref}, usually 20 °C, in Ω;

α is temperature coefficient of resistance for the conductor material (copper = 0,003 93) per °C;

T is conductor temperature in °C;

T_{ref} is reference temperature that α is specified at for the conductor material in °C.

6.6.3.4 Direct current (DC) resistance unbalance

The DC resistance unbalance requirements are applicable to all single pair cabling Classes.

The DC resistance unbalance between the two conductors of a single pair channel shall not exceed 3 % or 200 mΩ, whichever is greater.

6.6.3.5 DC current carrying capacity

ISO/IEC TS 29125 shall be used to assess the DC current carrying capacity. ISO/IEC 14763-2 shall be used to apply proper planning and installation. Each conductor of a single pair cabling channel is intended to support DC current carrying capacity of up to 2,0 A, dependent on installation conditions. Single pair channels shall be administrated and labelled according to ISO/IEC 14763-2.

Multi-pair cabling using Category 5 through Category 8.2 cabling components support 0,75 A. When using these components within a single pair channel, the resulting channel is limited to 0,75 A, see ISO/IEC TR 11801-9911.

NOTE Table G.2 provides guidance regarding the maximum channel length in relation to remote powering.

6.6.3.6 Dielectric withstand

The minimum dielectric withstand requirements are applicable to all single pair cabling Classes.

Dielectric withstand of single pair channels shall be a minimum of 1 000 V DC conductor-to-conductor and shall be a minimum of 1 000 V DC conductor-to-screen or conductor to earth, if a screen is not present, in accordance with IEC 61196-1-105.

6.6.3.7 Propagation delay

The maximum propagation delay requirements are applicable to all single pair cabling Classes.

The propagation delay of a single pair channel shall meet the requirements in Table 151. Propagation delay values for a single pair channel at key frequencies are given in Table 152 for information only.

Table 151 – Propagation delay for a single pair channel

Class	Frequency MHz	Maximum propagation delay µs
T1-A-1000	$0,1 \le f \le 20$	$5,340 + \frac{0,360}{\sqrt{f}} + 10 \times 0,0025$
T1-A-400	$0,1 \le f \le 20$	$2,136 + \frac{0,144}{\sqrt{f}} + 5 \times 0,0025$
T1-A-100	$0,1 \le f \le 20$	$0,534 + \frac{0,036}{\sqrt{f}} + 4 \times 0,0025$
T1-B	$0,1 \le f \le 600$	$0,534 + \frac{0,036}{\sqrt{f}} + 4 \times 0,0025$
T1-C	$0,1 \le f \le 1\,250$	$0,534 + \frac{0,036}{\sqrt{f}} + 4 \times 0,0025$

Table 152 – Informative propagation delay values for a single pair channel at key frequencies

Frequency MHz	Maximum propagation delay µs				
	Class				
	T1-A-1000	T1-A-400	T1-A-100	T1-B	T1-C
0,1	6,503	2,604	0,658	0,658	0,658
1	5,725	2,293	0,580	0,580	0,580
20	5,445	2,181	0,552	0,552	0,552
100	–	–	–	0,548	0,548
250	–	–	–	0,546	0,546
500	–	–	–	0,546	0,546
600	–	–	–	0,545	0,545
1 000	–	–	–	–	0,545
1 250	–	–	–	–	0,545

6.6.3.8 Unbalance attenuation and coupling attenuation

6.6.3.8.1 General

Unbalance attenuation (*TCL* and *ELTCTL*) is specified for unscreened systems. Coupling attenuation is specified for screened systems.

6.6.3.8.2 Unbalance attenuation, near-end

The unbalance attenuation near-end is measured as transverse conversion loss (*TCL*).

Minimum *TCL* requirements are applicable to unscreened systems. The *TCL* of a single pair channel that is intended to be subjected to an environmental classification E_x shall meet the requirements in Table 153. *TCL* values for a single pair unscreened channel at key frequencies are given in Table 154 for information only.

The *TCL* requirements shall be met at both ends of the cabling.

Table 153 – TCL for a single pair channel for unscreened systems

Class	Frequency MHz	Environmental classification		
		E_1	E_2 [b]	E_3 [b]
		Minimum TCL[a] dB		
T1-A	$0{,}1 \le f \le 20$	$50 - 20\lg\left(\frac{f}{10}\right)$	$50 - 20\lg\left(\frac{f}{10}\right)$	$60 - 20\lg\left(\frac{f}{10}\right)$
T1-B	$0{,}1 \le f \le 600$	$50 - 20\lg\left(\frac{f}{10}\right)$	$60 - 20\lg\left(\frac{f}{10}\right)$	$70 - 20\lg\left(\frac{f}{10}\right)$
T1-C	$0{,}1 \le f \le 1\,250$	$50 - 20\lg\left(\frac{f}{10}\right)$	$60 - 20\lg\left(\frac{f}{10}\right)$	$70 - 20\lg\left(\frac{f}{10}\right)$

NOTE E_1, E_2 and E_3 relate to the MICE environmental classification.

[a] Calculated values of greater than 50 dB shall revert to a requirement of 50 dB.

[b] Reference implementation does not ensure channel compliance for E_2 or E_3.