

ISO/IEC TR 11801-9906:2020-02 (E)

Information technology - Generic cabling for customer premises - Part 9906: Balanced 1-pair cabling channels up to 600 MHz for single pair Ethernet (SPE)

Contents	Page
FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and symbols.....	9
3.1 Terms and definitions.....	9
3.2 Symbols.....	10
4 Balanced 1-pair cabling channels	10
4.1 General.....	10
4.2 Component specifications	11
4.3 Environmental classifications	11
4.4 Channel reference implementations	12
4.5 Balanced 1-pair cabling channel signal transmission specifications.....	12
4.5.1 Return loss (RL)	12
4.5.2 Insertion loss (IL).....	12
4.5.3 Unbalance attenuation and coupling attenuation.....	13
4.5.4 Alien (exogenous) crosstalk.....	15
4.5.5 DC loop resistance	16
4.5.6 Propagation delay.....	16
Annex A (informative) Balanced 1-pair cable specifications.....	17
A.1 General.....	17
A.2 Cables using alternative conductor sizes	17
A.3 Balanced 1-pair cable specifications	17
A.3.1 Return loss (RL)	17
A.3.2 Insertion loss (IL).....	18
A.3.3 Unbalance attenuation and coupling attenuation.....	18
A.3.4 Alien (exogenous) crosstalk.....	20
A.3.5 DC resistance	21
A.3.6 Propagation delay.....	21
Annex B (informative) Balanced 1-pair connector specifications.....	22
B.1 General.....	22
B.2 Balanced 1-pair connector specifications	22
B.2.1 Return loss (RL)	22
B.2.2 Insertion loss (IL).....	22
B.2.3 Unbalance attenuation and coupling attenuation.....	23
B.2.4 Alien (exogenous) crosstalk.....	24
B.2.5 DC resistance (DCR)	25
B.2.6 Propagation delay (delay).....	25

Annex C (informative) Link segment specifications	26
C.1 General.....	26
C.2 Return loss (RL).....	26
C.2.1 1000BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD4	26
C.2.2 100BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD1	26
C.2.3 10BASE-T1S, IEEE 802.3cg	26
C.2.4 10BASE-T1L, IEEE 802.3cg	27
C.3 Insertion loss (IL).....	27
C.3.1 1000BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD4	27
C.3.2 100BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD1	27
C.4 TCL - 10BASE-T1L, IEEE 802.3cg	28
C.5 ELTCTL - 10BASE-T1L, IEEE 802.3cg.....	29
C.6 PS ANEXT	29
C.6.1 1000BASE-T1, Type A, ISO/IEC/IEEE 8802-3:2017/AMD4	29
C.6.2 1000BASE-T1, Type B, ISO/IEC/IEEE 8802-3:2017/AMD4	29
C.6.3 100BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD1	29
C.6.4 10BASE-T1S, IEEE 802.3cg	30
C.6.5 10BASE-T1L, IEEE 802.3cg	30
C.7 PS AACR-F.....	30
C.7.1 1000BASE-T1, Type A, ISO/IEC/IEEE 8802-3:2017/AMD4	30
C.7.2 1000BASE-T1, Type B, ISO/IEC/IEEE 8802-3:2017/AMD4	30
C.7.3 100BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD1	31
C.7.4 10BASE-T1S, IEEE 802.3cg	31
C.7.5 10BASE-T1L, IEEE 802.3cg	31
C.8 Coupling attenuation	31
C.8.1 1000BASE-T1, Type A, ISO/IEC/IEEE 8802-3:2017/AMD4	31
C.8.2 1000BASE-T1, Type B, ISO/IEC/IEEE 8802-3:2017/AMD4	32
C.8.3 100BASE-T1, ISO/IEC/IEEE 8802-3:2017/AMD1	32
C.8.4 10BASE-T1S, IEEE 802.3cg	32
C.8.5 10BASE-T1L, IEEE 802.3cg	32
C.9 Delay	33
C.9.1 1000BASE-T1, Type A, ISO/IEC/IEEE 8802-3:2017/AMD4	33
C.9.2 1000BASE-T1, Type B, ISO/IEC/IEEE 8802-3:2017/AMD4	33
C.9.3 10BASE-T1L, IEEE 802.3cg	33
Annex D (informative) Considerations for balanced 1-pair channels bundled in a 4-pair cabling channel.....	34
Annex E (informative) Conductor size effects for reduced insertion loss.....	35
E.1 Channel parameters affected by conductor size and AWG	35
E.2 IL parameter variation due to conductor size variation	36
E.3 AWG	36
Bibliography	37
Table 1 – SPE signal transmission functional space.....	11
Table 2 – Balanced 1-pair cabling channel return loss (RL).....	12
Table 3 – Balanced 1-pair cabling channel IL.....	13
Table 4 – Balanced 1-pair cabling channel TCL	14
Table 5 – Balanced 1-pair cabling channel ELTCTL	14
Table 6 – Balanced 1-pair cabling channel coupling attenuation	15
Table 7 – Balanced 1-pair cabling channel PS ANEXT	15
Table 8 – Balanced 1-pair cabling channel PS AACR-F	16
Table 9 – Balanced 1 pair cabling channel DC loop resistance	16

Table 10 – Balanced 1-pair cabling channel propagation delay	16
Table A.1 – Balanced 1-pair cable standards	17
Table A.2 – Balanced 1-pair cable RL	18
Table A.3 – Balanced 1-pair cable IL	18
Table A.4 – Balanced 1-pair cable TCL	19
Table A.5 – Balanced 1-pair cable ELTCTL	19
Table A.6 – Balanced 1-pair cable coupling attenuation	20
Table A.7 – Balanced 1-pair cable PS ANEXT	20
Table A.8 – Balanced 1-pair cable PS AACR-F	21
Table A.9 – Balanced 1-pair cable DC resistance.....	21
Table A.10 – Balanced 1-pair cable propagation delay.....	21
Table B.1 – Balanced 1-pair connector standards	22
Table B.2 – Balanced 1-pair connector RL	22
Table B.3 – Balanced 1-pair connector IL	23
Table B.4 – Balanced 1-pair connector TCL	23
Table B.5 – Balanced 1-pair connector TCTL	23
Table B.6 – Balanced 1-pair connector coupling attenuation	24
Table B.7 – Balanced 1-pair connector PS ANEXT.....	24
Table B.8 – Balanced 1-pair connector PS AACR-F	24
Table B.9 – Balanced 1-pair connector DCR	25
Table B.10 – Balanced 1-pair connector delay	25
Table C.1 – Return loss limits for 15 m and 40 m link segment	26
Table C.2 – Return loss limits for 15 m link segment.....	26
Table C.3 – Return loss limits for 15 m link segment.....	26
Table C.4 – Return loss limits for 1 000 m link segment.....	27
Table C.5 – Insertion loss limits of a 15 m and 40 m link segment.....	27
Table C.6 – Insertion loss limits for a 15 m link segment.....	27
Table C.7 – Insertion loss limits for a 15 m link segment.....	28
Table C.8 – Insertion loss limits for a 1 000 m link segment.....	28
Table C.9 – TCL for a 1 000 m link segment	28
Table C.10 – ELTCTL for a 1 000 m link segment	29
Table C.11 – PS ANEXT for a 15 m link segment.....	29
Table C.12 – PS ANEXT for a 40 m link segment.....	29
Table C.13 – PS ANEXT for a 15 m link segment.....	29
Table C.14 – PS ANEXT for a 15 m link segment.....	30
Table C.15 – PS ANEXT for a 1 000 m link segment.....	30
Table C.16 – PS AACR-F for a 15 m link segment	30
Table C.17 – PS AACR-F for a 40 m link segment	30
Table C.18 – PS AACR-F for a 15 m link segment	31
Table C.19 – PS AACR-F for a 15 m link segment	31
Table C.20 – PS AACR-F for a 1 000 m link segment.....	31
Table C.21 – Coupling attenuation for a 15 m link segment.....	31
Table C.22 – Coupling attenuation for a 40 m link segment.....	32
Table C.23 – Coupling attenuation for a 15 m link segment.....	32
Table C.24 – Coupling attenuation for a 15 m link segment.....	32
Table C.25 – Coupling attenuation for a 1 000 m link segment.....	32

Table C.26 – Delay for a 15 m link segment.....	33
Table C.27 – Delay for a 40 m link segment.....	33
Table C.28 – Delay for a 1 000 m link segment.....	33
Table E.1 – Conductor diameter IL factors to be used with example 24 AWG cable with 1,8 conductor IL coefficient.....	35