Table 50 –Requirements for internal cable assemblies using SASDrive connectors and backplanes.

Requirement [a, b]	**Units**	**1,5 Gbps**	**3Gbps**	**6 Gbps**
Bulk cable or backplane: [c, d]				
Differential impedance	ohm	100 ± 10		100 [g]
Maximum differential impedance imbalance [e]	ohm	5		
Common-mode impedance	ohm	32,5 ± 7,5		
Mated connectors: [d, f]				
Differential impedance	ohm	100 ± 15		100 [g]
Maximum differential impedance imbalance [e]	ohm	5		

a All measurements are made through mated connector pairs

b The equivalent maximum TDR rise time from 20 % to 80 % shall be 70 ps. Filtering may be used to obtain the equivalent rise time. The filter consists of the two-way launch/return path of the test fixture, the two-way launch/return path of the test cable, and the software or hardware filtering of the TDR scope. The equivalent rise time is the rise time of the TDR scope output after application of all filter components. When configuring software or hardware filters of the TDR scope to obtain the equivalent rise time, filtering effects of test cables and test fixtures shall be included.

c The impedance measurement identifies the impedance mismatches present in the bulk cable or backplane when terminated in its characteristic impedance. This measurement excludes mated connectors at both ends of the bulk cable or backplane, when present, but includes any intermediate connectors or splices.

d Where the bulk cable or backplane has an electrical length of > 4 ns the procedure detailed in SFF-8410, or an equivalent procedure, shall be used to determine the impedance.

e The difference in measured impedance to SIGNAL GROUND on the plus and minus terminals on the interconnect, transmitter device, or receiver device, with a differential test signal applied to those terminals.

f The mated connectors measurement applies only to the mated connector pair at each end, as applicable.

g This is a reference impedance only.

The tables below with the addition of the 6Gbs column and the Differential to Common mode conversion rows are copied from the SAS2 r12 document on the T10 web site.

Table 51 –Requirements for internal cable assemblies using SAS 4i or Mini SAS 4i

Requirement [a, b]	**Units**	**1,5 Gbps**	**3Gbps**	**6 Gbps**
Bulk cable: [c, d]				
Differential impedance	ohm	100 ± 10		100 [k]
Maximum differential impedance imbalance [e]	ohm	5		
Common-mode impedance	ohm	32,5 ± 7,5		
Mated connectors: [d, f]				
Differential impedance	ohm	100 ± 15		100 [k]
Maximum differential impedance imbalance [e]	ohm	5		
Cable Assembly: [g]				
Maximum Insertion Loss [h]	dB	6		6
Maximum intra-pair skew [i, j]	ps	10		
Differential to Common Mode Conversion, SDC21 [l]	dB	NA		

a All measurements are made through mated connector pairs.

b The equivalent maximum TDR rise time from 20 % to 80 % shall be 70 ps. Filtering may be used to obtain the equivalent rise time. The filter consists of the two-way launch/return path of the test fixture, the two-way launch/return path of the test cable, and the software or hardware filtering of the TDR scope. The equivalent rise time is the rise time of the TDR scope output after application of all filter components. When configuring software or hardware filters of the TDR scope to obtain the equivalent rise time, filtering effects of test cables and test fixtures shall be included.

c The impedance measurement identifies the impedance mismatches present in the bulk cable when terminated in its characteristic impedance. This measurement excludes mated connectors at both ends of the bulk cable, when present, but includes any intermediate connectors or splices.

d Where the bulk cable has an electrical length of > 4 ns, the procedure detailed in SFF-8410, or an equivalent procedure, shall be used to determine the impedance.

e The difference in measured impedance to SIGNAL GROUND on the plus and minus terminals on the interconnect, transmitter device, or receiver device, with a differential test signal applied to those terminals.

f The mated connectors measurement applies only to the mated connector pair at each end, as applicable.

g The internal cable assembly is part of a TxRx connection that complies with the requirements for intra-enclosure compliance points defined in 5.3.

h The range for this frequency domain measurement is 10 MHz to 4 500 MHz.

i The far end of the mated cable assembly shall be terminated in its characteristic impedance. Insertion loss variations (i.e., cable length) may change the measurement result.

j The procedure detailed in SFF-8410, or an equivalent procedure, shall be used to determine the intra-pair skew.

k This is a reference impedance only.

l Refer to fig 121 or 124 in latest 6Gb Phy elec. Spec., or add another slope figure for cables below. Still need to fill in equation variables.

Table 52 – Additional requirements for cable assemblies using SAS 4i

Requirement a, b, c, d	Units	1,5 Gbps	3 Gbps	6 Gbs
Maximum near-end crosstalk on any of the following (adjacent) signal pairs: Rx 0/Tx 0, Tx 0/Rx 1, Rx 1/Tx 1, Rx 2/Tx 2, Tx 2/Rx 3, and Rx 3/Tx 3	dB	-33		
Maximum near-end crosstalk on any of the following signal pairs: Rx 0/Rx 1, Rx 0/Tx 1, Tx 0/Tx 1, Rx 2/Rx 3, Rx 2/Tx 3, and Tx 2/Tx 3	dB	-45		
Maximum near-end crosstalk on all other signal pairs	dB	-50		

a All measurements are made through mated connector pairs.
b The equivalent maximum TDR rise time from 20 % to 80 % shall be 70 ps. Filtering may be used to obtain the equivalent rise time. The filter consists of the two-way launch/return path of the test fixture, the two-way launch/return path of the test cable, and the software or hardware filtering of the TDR scope. The equivalent rise time is the rise time of the TDR scope output after application of all filter components. When configuring software or hardware filters of the TDR scope to obtain the equivalent rise time, filtering effects of test cables and test fixtures shall be included.
c The range for this frequency domain measurement is 10 MHz to 4 500 MHz.
d The far end of the mated cable assembly shall be terminated in its characteristic impedance. Insertion loss variations (i.e., cable length) may change the measurement result.

Table 53 – Additional requirements for cable assemblies using Mini SAS 4i

Requirement a, b, c, d	Units	1,5 Gbps	3 Gbps	6 Gbps
Maximum near-end crosstalk for each receive pair	dB	-26		

a All measurements are made through mated connector pairs.
b Determine all valid aggressor/victim near-end crosstalk transfer modes. Over the complete frequency range of this measurement, determine the sum of the crosstalk transfer ratios, measured in the frequency domain, of all crosstalk transfer modes. To remove unwanted bias due to test fixture noise, magnitudes less than -50 dB (e.g., -60 dB) at all frequencies may be ignored. The following equation details the summation process of the four valid near-end crosstalk sources. All NEXT values expressed in dB format in a passive transfer network shall have negative dB magnitude.

$$\text{TotalNEXT } f() = 10 \times \log f() \sum_{1}^{4} 10^{(\text{NEXT } (f)/10)}$$

c The range for this frequency domain measurement is 10 MHz to 4 500 MHz.
d The far end of the mated cable assembly shall be terminated in its characteristic impedance. Insertion loss variations (i.e., cable length) may change the measurement result.

Table 54 –Requirements for external cable assemblies

Requirement [a, b]	Units	1,5 Gbps	3Gbps	6 Gbps

Bulk cable: [c, d]			
Differential impedance	ohm	100 ± 10	100 [l]
Maximum differential impedance imbalance [e]	ohm	5	
Common-mode impedance	ohm	32,5 ± 7,5	
Mated connectors:			
Differential impedance [f, d]	ohm	100 ± 15	100 [l]
Cable Assembly: [g]			
Maximum Insertion Loss	dB	**See 5.3.3**	
Maximum Rise Time [h, i]	ps	150	
Maximum ISI	ps	60	
Maximum intra-pair skew [h, k]	ps	50	
Differential to Common Mode Conversion, SCD21 [m]	dB	NA	

a All measurements are made through mated connector pairs.

b The equivalent maximum TDR rise time from 20 % to 80 % shall be 70 ps. Filtering may be used to obtain the equivalent rise time. The filter consists of the two-way launch/return path of the test fixture, the two-way launch/return path of the test cable, and the software or hardware filtering of the TDR scope. The equivalent rise time is the rise time of the TDR scope output after application of all filter components. When configuring software or hardware filters of the TDR scope to obtain the equivalent rise time, filtering effects of test cables and test fixtures shall be included.

c The impedance measurement identifies the impedance mismatches present in the bulk cable when terminated in its characteristic impedance. This measurement excludes mated connectors at both ends of the bulk cable, when present, but includes any intermediate connectors or splices.

d Where the bulk cable has an electrical length of > 4 ns, the procedure detailed in SFF-8410, or an equivalent procedure, shall be used to determine the impedance.

e The difference in measured impedance to SIGNAL GROUND on the plus and minus terminals on the interconnect, transmitter device, or receiver device, with a differential test signal applied to those terminals.

f The mated connectors measurement applies only to the mated connector pair at each end, as applicable.

g The external cable assembly is part of a TxRx connection that complies with the requirements for intra-enclosure compliance points defined in 5.3.

h The far end of the mated cable assembly shall be terminated in its characteristic impedance. Insertion loss variations (i.e., cable length) may change the measurement result.

i Connect the TDR step impulse response generators to the near end of the cable assembly and measure the output rise time at the far end. The input rise time shall be no higher than 35ps.

j Measured DJ at the far end of the cable assembly under test using a lone bit pattern (see table 306 in 10.2.9.2) at 3Gbps

k The procedure in SFF-8410, or an equivalent procedure, shall be used to determine the intra-pair skew.

l This is a reference impedance only.

m Need something here about how this is measured and to what frequency???

Table 55 – Additional requirements for external cable assemblies using SAS 4x

Requirement [a, b, c]	Units	1,5 Gbps	3 Gbps	6 Gbps
Frequency domain measurement range 10 MHz to 2 250 MHz:				
Maximum near-end crosstalk from any single aggressor pair offset by one position (i.e., adjacent)(e.g., Rx 0/Rx 1)	dB	-30		
Maximum near-end crosstalk from any single aggressor pair offset by two positions (e.g., Rx 0/Rx 2)	dB	-36		
Maximum near-end crosstalk from any single aggressor pair offset by more than two positions (e.g., Rx 0/Rx 3)	dB	-40		
Frequency domain measurement range 2 250 Mhz to 4 500 MHz:				
Maximum near-end crosstalk from any single aggressor pair offset by one position (i.e., adjacent)(e.g., Rx 0/Rx 1)	dB	-24		
Maximum near-end crosstalk from any single aggressor pair offset by two positions (e.g., Rx 0/Rx 2)	dB	-30		
Maximum near-end crosstalk from any single aggressor pair offset by more than two positions (e.g., Rx 0/Rx 3	dB	-40		

a All measurements are made through mated connector pairs.

b The equivalent maximum TDR rise time from 20 % to 80 % shall be 70 ps. Filtering may be used to obtain the equivalent rise time. The filter consists of the two-way launch/return path of the test fixture, the two-way launch/return path of the test cable, and the software or hardware filtering of the TDR scope. The equivalent rise time is the rise time of the TDR scope output after application of all filter components. When configuring software or hardware filters of the TDR scope to obtain the equivalent rise time, filtering effects of test cables and test fixtures shall be included.

c The far end of the mated cable assembly shall be terminated in its characteristic impedance. Insertion loss variations (i.e., cable length) may change the measurement result.

Table 55 – Additional requirements for external cable assemblies using SAS 4x

Requirement [a, b, c, d]	**Units**	**1,5 Gbps**	**3 Gbps**	**6 Gbs**
Maximum near-end crosstalk for each receive pair	dB	-26		

a All measurements are made through mated connector pairs.

b Determine all valid aggressor/victim near-end crosstalk transfer modes. Over the complete frequency range of this measurement, determine the sum of the crosstalk transfer ratios, measured in the frequency domain, of all crosstalk transfer modes. To remove unwanted bias due to test fixture noise, magnitudes less than -50 dB (e.g., -60 dB) at all frequencies may be ignored. The following equation details the summation process of the four valid near-end crosstalk sources. All NEXT values expressed in dB format in a passive transfer network shall have negative dB magnitude.

$$\text{TotalNEXT } f() = 10 \times \log \sum_{1}^{4} = 10^{(\text{NEXT } f() \ 10)}$$

c The range for this frequency domain measurement is 10 MHz to 4 500 MHz.

d The far end of the mated cable assembly shall be terminated in its characteristic impedance. Insertion loss variations (i.e., cable length) may change the measurement result.