NETCONNECT* Enhanced Category 5 System

1. INTRODUCTION

1.1. Purpose

Testing was performed on the NETCONNECT* Enhanced Category 5 Systems to determine conformance to the requirements of AMP Product Specification 108-1879 Revision A.

1.2. Scope

This report covers the electrical transmission performance testing of the Enhanced Category 5 Systems manufactured by the AMP Incorporated. The testing was performed between 19Oct98 and 11Nov98. The test file number for this testing is CTL B006792-001. This documentation is on file at and available from the Americas Regional Laboratory.

1.3. Conclusion

The Enhanced Category 5 Systems met the electrical transmission performance requirements of AMP Product Specification 108-1879 Revision A.

1.4. Product Description

The Enhanced Category 5 System components were tested in systems to determine compliance. If there is compliance, the components used in the system can be used in AMP Warranted Systems. Please note that the following part numbers use the same subassemblies as in 406330-1 thus, they can be considered to compliant also.

Part Number	Revision	Description
406331-1	C	Enhanced Category 5 Patch Panel, 48 port
406332-1	C	Enhanced Category 5 Patch Panel, 96 port
406390-1	E	Enhanced Category 5 Patch Panel, 12 port

Figure 1

1.5. Test Specimens

The test specimens were randomly selected from normal current production lots. The following part numbers were used for testing:

Quantity	Part Number	Revision	Description
2	406330-1	F	Enhanced Category 5 Patch Panel
6	558840-1	D	110XC Wiring Block
25	406350-2	A	Edge Connector Assembly, 110, AMP ACO
50	558401-1	H	Connector Block Assembly, 4 Pair, XC 110Connect
10	558908-1	D	568A ACO Insert
10	558909-1	C	568B ACO Insert
10	557280-1	D	Enet/TR ACO Insert
10	557260-1	C	Dual Token Ring & 10/100 Base-T ACO Insert
10	557907-1	B	Dual Enet ACO Insert
10	557272-1	F	Dual ATM ACO Insert
10	558913-1	A	TR/ATM ACO Insert
10	558914-1	A	Enet/ATM ACO Insert
3	3-57826-4	F	Enhanced Category 5 Cable
4	406772-1	A	110/RJ45 CP Module
1	406810-1	A	MUO w/ 110/RJ45
80	406372-1	F	RJ45 Modular Jack
10	219245-7	A	2 m Cable Assembly, Modular Plug, 8 position, White, Enhanced Category 5
5	2-406483-0	E	6 m Cable Assembly, Modular Plug, 8 position, Black, Enhanced Category 5
3	5-406483-0	B	15 m Cable Assembly, Modular Plug, 8 position, Black, Enhanced Category 5
3	2-219187-0	A	20 m Cable Assembly, Modular Plug, 8 position, Black, Enhanced Category 5
3	569526-6	B	2 m Patch Cord Assembly, 4 pair, 110/110
3	569528-8	D	2 m Patch Cord Assembly, 4 pair, 110/RJ45, T568B
3	219185-4	A	15 m Cable Assembly, Modular Plug, 8 position, FutureLan, Category 5, CMR, 568A
5	219185-8	A	15 m Cable Assembly, Modular Plug, 8 position, FutureLan, Category 5, CMR, 568B

Figure 2

1.6. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing.

Temperature: 15 to 35°C
Relative Humidity: 20 to 80%

1.7. Qualification Test Sequence

Each of these tests were performed on each configuration of the attached Systems Test Matrix dated 14Oct8.

Test or Examination	Test Groups (a)		
	1	2	3
	Test Sequence (b)		
Examination of Product	1,12		
Attenuation	2		
Near End Crosstalk (NEXT)	3		
Power Sum Near End Crosstalk (PS NEXT)	4		
Equal Level Far End Crosstalk (ELFEXT)	5		
Power Sum Equal Level Far End Crosstalk (PS ELFEXT)	6		
Return Loss	7		
Attenuation Crosstalk Ratio (ACR)	8		
Power Sum Attenuation Crosstalk Ratio (PS ACR)	9		
Propagation Delay	10		
Delay Skew	11		

NOTE

(a) See Para 1.5.
(b) The numbers indicate sequence in which tests were performed.

Figure 3

2. SUMMARY OF TESTING

2.1. Examination of Product

All samples submitted for testing were randomly selected from current production lots. A Certificate of Conformance was issued by the appropriate business unit. Where specified, samples were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Attenuation

All attenuation results were within the limits specified in Figure 4.

2.3. Near End Crosstalk (NEXT)

All NEXT results were within the limits specified in Figure 4.

2.4. Power Sum Near End Crosstalk (PS NEXT)

All PS NEXT results were within the limits specified in Figure 4.

2.5. Equal Level Far End Crosstalk (ELFEXT)

All ELFEXT results were within the limits specified in Figure 4.

2.6. Power Sum Equal Level Far End Crosstalk (PS ELFEXT)

All PS ELFEXT results were within the limits specified in figure 4.

2.7. Return Loss

All return loss results were within the limits specified in Figure 4.

2.8. Attenuation Crosstalk Ratio (ACR)

Channel configurations only. All ACR results were within the limits specified in Figure 4.

2.9. Power Sum Attenuation Crosstalk Ratio (PS ACR)

Channel configurations only. All PS ACR results were within the limits specified in Figure 4.

2.10. Propagation Delay

All propagation delay results were within the limits specified in Figure 4.

2.11. Delay Skew

All delay skew results were within the limits specified in Figure 4.

3. TEST METHODS

3.1. Examination of Product

Where specified, samples were visually examined for evidence of physical damage detrimental to product performance.

3.2. Attenuation

A network analyzer was used to measure the scattering parameters S_{11} and S_{21} of the sample. The attenuation was then calculated from these measurements. Attenuation is a loss measurement and is expressed in dB.

3.3. Near End Crosstalk (NEXT)

Sinusoidal frequencies of 1 MHz to 100 MHz were applied to one end of the "driven line". The "quiet line" was monitored at the same end with a network analyzer to measure any crosstalk signals. The NEXT is expressed in dB.

3.4. Power Sum Near End Crosstalk (PS NEXT)

The PS NEXT was calculated from the NEXT and is expressed in dB.

3.5. Equal Level Far End Crosstalk (ELFEXT)

ELFEXT was calculated by measuring the Far End Crosstalk (FEXT). FEXT loss was measured by applying sinusoidal frequencies of 1 to 100 MHz to one end of the "driven line". The "quiet line" was monitored at the far end with a network analyzer to measure any crosstalk signals. ELFEXT is then expressed in dB as the difference between the measured FEXT and the attenuation of the disturbed pair.

3.6. Power Sum Equal Level Far End Crosstalk (PS ELFEXT)

The PS ELFEXT was calculated from the ELFEXT and is expressed in dB.

3.7. Return Loss

Sinusoidal frequencies of 1 to 100 MHz were applied to one end of the specimen. The signal passing through a system loses some of its amplitude due to a reflection which returns to the source. In a “good” system, the reflected wave has a small amplitude, so the returning wave can be said to have a high return loss. Return loss is the ratio of incident to reflected power and is expressed in dB.

3.8. Attenuation Crosstalk Ratio (ACR)

ACR is a calculated value which is determined by NEXT - Attenuation. ACR is expressed in dB.

3.9. Power Sum Attenuation Crosstalk Ratio (PS ACR)

PS ACR is a calculated value which is determined by PS NEXT - Attenuation. PS ACR is expressed in dB.

3.10. Propagation Delay

Propagation delay is a measure of how long it takes a signal to propagate from one end of a system to the other. Propagation delay is expressed in ns.

3.11. Delay Skew

Delay skew is a calculated value and it is the difference between the propagation delays of the different pairs. Skew is expressed in ns.

Channel Specification Limits

Frequency (MHz) (a)	Attenuation (dB) (b)	NEXT (dB) (c)	PS NEXT (dB) (d)	ELFEXT (dB) (e)	PS ELFEXT (dB) (f)	Return Loss (dB) (g)	ACR (dB) (h)	PS ACR (dB) (I)	Prop Delay (ns) (j)	Skew (ns) (k)
1.0	2.5	63.3	60.0	57.4	54.4	17	60.8	57.5	-	-
4.0	4.5	53.6	50.9	45.3	42.4	17	49.1	46.4	-	-
8.0	6.3	48.6	45.7	39.3	36.3	17	42.3	39.4	-	-
10.0	7.0	47.0	44.1	37.4	34.4	17	40.0	37.1	<555	<50
16.0	9.2	43.6	40.6	33.3	30.3	17	34.4	31.4	-	-
20.0	10.3	42.0	39.0	31.4	28.4	17	31.7	28.7	-	-
25.0	11.4	40.4	37.3	29.4	26.4	16	29.0	25.9	-	-
31.25	12.8	38.7	35.7	27.5	24.5	15	25.9	22.9	-	-
62.5	18.5	33.6	30.6	21.5	18.5	12	15.1	12.1	-	-
100.0	24.0	30.1	27.1	17.4	14.4	10	6.1	3.1	-	-

Link Specification Limits

Frequency (MHz) (a)	Attenuation (dB) (b)	NEXT (dB) (c)	PS NEXT (dB) (d)	ELFEXT (dB) (e)	PS ELFEXT (dB) (f)	Return Loss (dB) (g)	Prop Delay (ns) (j)	Skew (ns) (k)
1.0	2.1	64.2	60.0	60.0	57.0	17	-	-
4.0	4.0	54.8	52.0	48.0	45.0	17	-	-
8.0	5.7	50.0	47.1	41.9	38.9	17	-	-
10.0	6.3	48.5	45.6	40.0	37.0	17	<518	<45
16.0	8.2	45.2	42.2	35.9	32.9	17	-	-
20.0	9.2	43.7	40.7	34.0	31.0	17	-	-
25.0	10.3	42.1	39.1	32.0	29.0	16	-	-
31.25	11.5	40.6	37.5	30.1	27.1	16	-	-
62.5	16.7	35.7	32.6	24.1	21.1	14	-	-
100.0	21.6	32.3	29.3	20.0	17.0	12	-	-

NOTE

(a) TIA/EIA TSB67, October 1995.
(b) Table 1/2 of TIA/EIA TSB67, October 1995.
(c) Table 3/4 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25, 1998.
(d) Table 6/7 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25, 1998.
(e) Table 10/11 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25, 1998.
(f) Table 13/14 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25, 1998.
(g) Table 17/18 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25, 1998.
(h) Calculation: ACR = NEXT - Attenuation.
(I) Calculation: PS ACR = PS NEXT - Attenuation.
(j) Section 5.4 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25 ,1998.
(k) Section 5.5 of Standards Proposal No. 4195-A, Proposed Addendum No. 5 to TIA/EIA-568-A, August 25 ,1998.

Figure 4