

Category 5e, 4 UTP, 24 AWG Undercarpet Cable

1. INTRODUCTION

1.1. Purpose

Testing was performed on Category 5e, 100 ohm, Unshielded Twisted Pair (UTP) undercarpet cable to determine its conformance to the requirements of Product Specification 108-2091 Revision A.

1.2. Scope

This report covers the transmission and mechanical testing of Category 5e, 100 ohm, UTP undercarpet cable. Testing was performed at the Global Automotive Division, Americas North Laboratory, between December 2003 and January 2004. The test file number for this testing is 20030206ACL. This documentation is on file at and available from the Global Automotive Division, Americas North Laboratory. Testing was also performed at Intertek Testing Services, Inc. on 30Nov01. This documentation is on file at and available from Intertek Testing Services, Inc. 3933 US Route 11, Cortland New York 13045.

1.3. Conclusion

The Category 5e, 100 ohm, UTP undercarpet cable listed in paragraph 1.5., conformed to the transmission and mechanical performance requirements of Product Specification 108-2091 Revision A.

1.4. Product Description

The Category 5e, 100 ohm, UTP undercarpet cable is designed for interconnection of voice and data devices by way of cabling that is easily concealed using carpet squares. The system is installed over smooth, level and continuous floor surfaces and is easily interfaced to building wiring eliminating the need for ductwork, poke-thru and telepoles.

1.5. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for testing:

Test Group	Quantity	Part Number	Description
1,2,3,4	50 feet each	1499119-1	Cable, 4 UTP, 24 AWG, Category 5e, CMUC
1,2,3,4	2 each	1375191-1	Assembly, SL 110 jack, Category 5e

Figure 1

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. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Initial examination of product	1	1	1	1
Propagation delay				2
Delay skew				3
Insertion Loss (IL)	2,6	2,6	2,6	4
Near End Crosstalk (NEXT)	3,7	3,7	3,7	5
Return Loss (RL)	4,8	4,8	4,8	6
Characteristic impedance (Z_0)				7
Power Sum Near End Crosstalk (PS NEXT)				8
Equal Length Far End Crosstalk (ELFEXT)				9
Power Sum Equal Length Crosstalk (PS ELFEXT)				10
Short term compression	5			
Long term compression		5		
Caster abuse			5	
Final examination of product	9	9	9	11

NOTE

- (a) See paragraph 1.5.
 (b) Numbers indicate sequence in which tests are performed.

Figure 2

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance (C of C) was issued by Intertek Testing Services under the ETL Verification Program. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Propagation Delay

All propagation delay measurements were less than 5.7 ns/m at 10 MHz, 570 ns/100m at 1 MHz, 545 ns/100m at 10 MHz and 538 ns/100m at 100 MHz.

2.3. Delay Skew

All delay skew measurements were less than 45 ns/100m.

2.4. Insertion Loss (IL)

All IL measurements were within limits specified in Figure 3.

Frequency (MHz)	NEXT (dB) See Note (a)	PS NEXT (dB) See Note (b)	IL (dB) See Note (c)	Input Impedance (ohms)	RL (dB) See Note (d)	ELFEXT Worst Pair (dB) See Note (e)	PS ELFEXT Pair-To-Pair (dB) See Note (f)
0.772	67	64	1.8	85 - 115	-	-	-
1.0	65.3	62.3	2.0	85 - 115	20.0	63.8	60.8
4.0	52.3	53.3	4.1	85 - 115	23.0	51.8	48.8
10.0	50.3	47.3	6.5	85 - 115	25.0	43.8	40.8
16.0	47.2	44.2	8.2	85 - 115	25.0	39.7	36.7
20.0	45.8	42.8	9.3	85 - 115	25.0	37.8	34.8
25.0	44.3	41.3	10.4	85 - 115	24.3	35.8	32.8
31.25	42.9	39.9	11.7	85 - 115	23.6	33.9	30.9
62.5	38.4	35.4	17.0	85 - 115	21.5	27.9	24.9
100.0	35.3	32.3	22.0	85 - 115	20.1	23.8	20.8

NOTE

- (a) NEXT limits are computed from:

$$NEXT \geq NEXT(100) - 15\log(f/100) \text{ dB}$$
- (b) Power Sum limits are computed from:

$$PS \text{ NEXT} \geq 32.3 - 15\log(f/100) \text{ dB}$$
- (c) Insertion Loss limits are computed from:

$$1.967 \sqrt{f} + 0.023 + 0.05/\sqrt{f}/100m \text{ dB}$$
- (d) Return Loss limits are computed from:

$$1 \leq f < 10 \quad 20 + 5\log(f)$$

$$10 \leq f < 20 = 25$$

$$20 \leq f \leq 100 = 25 - 7\log(f/20)$$
- (e) ELFEXT (worst pair) limits are computed from:

$$ELFEXT \geq 23.8 - 20\log(f/100) \text{ dB}$$
- (f) Power Sum ELFEXT (pair-to-pair) limits are computed from:

$$PS \text{ ELFEXT} \geq 20.8 - 20\log(f/100) \text{ dB}$$

Figure 3
 Category 5e (100 ohm) Performance Requirements

2.5. NEXT

All NEXT measurements were within limits specified in Figure 3.

2.6. RL

All RL measurements were within limits specified in Figure 3.

 2.7. Characteristic Impedance (Z_0)

All characteristic impedance measurements were within 100 ± 15 ohms (1 to 100 MHz).

2.8. PS NEXT

All PS NEXT measurements were within limits specified in Figure 3.

2.9. ELFEXT

All ELFEXT measurements were within limits specified in Figure 3.

2.10. PS ELFEXT

All PS ELFEXT measurements were within limits specified in Figure 3.

2.11. Short Term Compression

No evidence of physical damage was visible. All specimens met the IL, NEXT and RL requirements of Figure 3.

2.12. Long Term Compression

No evidence of physical damage was visible. All specimens met the IL, NEXT and RL requirements of Figure 3.

2.13. Caster Abuse

No evidence of physical damage was visible. All specimens met the IL, NEXT and RL requirements of Figure 3.

2.14. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Initial Examination of Product

A C of C was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3.2. Propagation Delay

Propagation delay was calculated per ASTM D4566-98, paragraph 40.

3.3. Delay Skew

Delay skew was calculated per ASTM D4566-98, paragraph 40 and TIA/EIA-568-B.2, paragraph 4.3.4.13.

3.4. IL

IL was tested per TIA/EIA-568-B.2, paragraph 4.3.4.7.

3.5. NEXT

NEXT was tested per TIA/EIA-568-B.2, paragraph 4.3.4.8.

3.6. RL

RL was tested per ASTM D4566-98, paragraph 45.3.

3.7. Characteristic Impedance (Z_0)

Characteristic impedance was tested per ASTM D4566-98, paragraph 44.

3.8. PS NEXT

PS NEXT was tested per ASTM D4566-98, paragraph 24.

3.9. ELFEXT

ELFEXT was tested per TIA/EIA-568-B.2, paragraph 4.3.4.10.

3.10. PS ELFEXT

PS ELFEXT was tested per ASTM D4566-98, paragraph 25.

3.11. Short Term Compression

Specimens were initially tested for electrical transmission. Specimens were then tested by placing a 12.7 mm [.5 in] diameter by 12.7 [.5 in] thick steel disc held in a chuck attached to the crosshead on an Instron machine over the center of the specimen placed on the base of the Instron machine. A load of 1.33 kN [300 lbf] was applied to the specimen for 3 seconds and released. This cycle was repeated 4 times for a total of 5 cycles. Specimens were again tested for electrical transmission.

3.12. Long Term Compression

Specimens were initially tested for electrical transmission. Specimens were then tested by placing a 12.7 mm [.5 in] diameter by 12.7 [.5 in] thick steel disc held in a chuck attached to the crosshead on an Instron machine over the center of the specimen placed on the base of the Instron machine. A load of 0.67 kN [150 lbf] was applied to the specimen for 10 days and released. Specimens were again tested for electrical transmission.

3.13. Caster Abuse

Specimens were initially tested for electrical transmission. Specimens were then placed on a trowel finished concrete floor under carpet squares. A load of 136.1 kg [300lb] was passed over the specimen in a direction perpendicular to the specimen. This cycle was repeated 99 times for a total of 100 cycles. Specimens were tested for electrical transmission every 10 cycles.

3.14. Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.