

## TEST REPORT No. 2001-166-270-TSE

August 6, 2001

### Transmission Performance Testing

**according to:** ISO/IEC JTC 1/SC 25 N 696 (2001)  
Limits relating to Channel Performance Class E

**Prepared for:** Telegärtner Karl Gärtner GmbH  
Lerchenstrasse 35  
D-71144 Steinenbronn

LEONI Kabel GmbH & Co.KG  
Stieberstr. 5  
D-91154 Roth

### Equipment under Test:

Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055

Type 1: VARIOFIT-Dose für Class E 250 MHz VAD 8/8 UP/50 EK RAL9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 UP/50 EK RAL 1013  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 UP/50 EK ohne Zentralplatte  
VARIOFIT-Dose für Class E 250 MHz VAD 8 UP/50 EK RAL 9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8 UP/50 EK RAL 1013  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 AP RAL 9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 AP RAL 1013  
VARIOFIT-Dose für Class E 250 MHz VAD 8 AP RAL 9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8 AP RAL 1013

Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.

Type 2: : Mod. Patch Panel Cat.6 MPP24-HS screened RAL 7035  
Mini Verteiler Cat.6 MPD12-HS screened  
Mini Verteiler Cat.6 Typ II MPD6-HS screened  
Mini Verteiler Cat.6 3HE / 8TE MPD6-HS screened  
Mini Verteiler Cat.6 3HE / 10TE MPD12-HS screened

Part number 3: M06019A0105

Type 3: : Microtest OmniScanner Cable Kit

Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

**Date tested:** 2001-08-06

**Test passed:** YES

**Testing Location:** ELMAC GmbH, Boschstrasse 2  
D-71149 Bondorf/Germany  
Tel: ++49(0)7457/9441-0 eMail: [info@elmac.de](mailto:info@elmac.de)  
Fax: ++49(0)7457/8044 WWW: <http://www.elmac.de>

Tested by: Schmidt 2001-08-06  
U. Schmidt Date

Engineer in charge: Bühne 2001-08-06  
J. Bühne Date

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## Notes:

ELMAC GmbH represents to the client that testing is done in accordance with the standard procedures stated under 2.1. All deviations will be listed separately.

The test results of this report are exclusively referring to the specific sample tested under stated test conditions. ELMAC GmbH shall have no liability for any deductions, inferences or generalizations drawn from the test results.

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## 2. Test Specifications and Equipment under Test

### 2.1. Test Specifications:

#### ISO/IEC JTC 1/SC 25 N 696 (2001)

IT-Cabling for Customer Premises  
Channel Performance Class E

#### Following tests had to be performed:

- Maximum Attenuation
- Minimum Next Loss
- Minimum Attenuation to Crosstalk Ratio (ACR)
- Minimum ELFEXT Loss
- Minimum PowerSum NEXT Loss
- Minimum PowerSum ELFEXT Loss
- Minimum PowerSum ACR
- Return Loss
- Propagation Delay
- Delay Skew
- Resistance

### 2.2. Specification of the Equipment under Test (EUT)

- Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055
- Type 1: VARIOFIT-Dose für Class E 250 MHz VAD 8/8 UP/50 EK RAL9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 UP/50 EK RAL 1013  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 UP/50 EK ohne Zentralplatte  
VARIOFIT-Dose für Class E 250 MHz VAD 8 UP/50 EK RAL 9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8 UP/50 EK RAL 1013  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 AP RAL 9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8/8 AP RAL 1013  
VARIOFIT-Dose für Class E 250 MHz VAD 8 AP RAL 9010  
VARIOFIT-Dose für Class E 250 MHz VAD 8 AP RAL 1013
- Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.
- Type 2: : Mod. Patch Panel Cat.6 MPP24-HS screened RAL 7035  
Mini Verteiler Cat.6 MPD12-HS screened  
Mini Verteiler Cat.6 Typ II MPD6-HS screened  
Mini Verteiler Cat.6 3HE / 8TE MPD6-HS screened  
Mini Verteiler Cat.6 3HE / 10TE MPD12-HS screened
- Part number 3: M06019A0105
- Type 3: : Microtest OmniScanner Cable Kit
- Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

### 3. Summary of the Test Results

#### 3.1. Overview

| Test                         | Test report<br>See<br>Paragraph | Test<br>passed | Remarks |
|------------------------------|---------------------------------|----------------|---------|
| Maximum Attenuation          | 4.1.                            | YES            |         |
| Minimum Next Loss            | 4.2.                            | YES            |         |
| Minimum ACR                  | 4.3.                            | YES            |         |
| Minimum ELFEXT Loss          | 4.4.                            | YES            |         |
| Minimum PowerSum NEXT Loss   | 4.5.                            | YES            |         |
| Minimum PowerSum ELFEXT Loss | 4.6.                            | YES            |         |
| Minimum PowerSum ACR         | 4.7.                            | YES            |         |
| Minimum Return Loss          | 4.8.                            | YES            |         |
| Propagation Delay            | 4.9.                            | YES            |         |
| Delay Skew                   | 4.10                            | YES            |         |
| Maximum Resistance           | 4.11                            | YES            |         |

#### 3.2. Verification and Certification Status

The EUT - specified in paragraph 2.2. - has been verified as being compliant with the standard ISO/IEC JTC 1/SC 25 N 696 (2001) relating to Channel Performance Class E.

## 4. Test Results

### 4.1. Attenuation

The attenuation was measured as the signal power loss due to the connecting hardware and was derived from swept frequency voltage measured on short lengths of twisted-pair test leads before and after splicing in the connector.

The summarized test results see table 1.

The required limits were met: **YES**

### 4.2. Next Loss

The Next loss was measured as the signal coupling from one cable pair to another. A balanced input signal was applied to a disturbing pair of the connector while the induced signal on the disturbed pair was measured. Each pair was terminated by a 100 Ohm one percent resistor on both sides.

The summarized test results see table 1.

The required limits were met: **YES**

### 4.3. Attenuation to Crosstalk Ratio (ACR)

The Attenuation to Crosstalk Ratio (ACR) was calculated from the results of attenuation and next loss measurements.

$$\text{ACR [dB]} = \text{Next loss [dB]} - \text{Attenuation [dB]}$$

The summarized test results see table 2.

The required limits were met: **YES**

### 4.4. ELFEXT Loss

Fext loss is a measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring pair measured at the far-end. ELFEXT Loss is expressed in dB as the difference between the measured FEXT loss and the attenuation of the disturbed pair.

$$\text{ELFEXT Loss [dB]} = \text{FEXT Loss [dB]} - \text{Attenuation [dB]}$$

The summarized test results see table 2.

The required limits were met: **YES**

### 4.5. Power Sum Next Loss

Power Sum Near End Crosstalk takes into account the combined crosstalk on a receive pair from all near end disturbers operating simultaneously. The power sum crosstalk ( Psum NEXT) is calculated in accordance to ASTM D4566 as a power sum on a selected pair from all other pairs as shown in equation for the case of 4-pair connecting hardware.

The summarized test results see table 3.

The required limits were met: **YES**

#### 4.6. Power Sum ELFEXT Loss

The power sum ELFEXT Loss ( Psum ELFEXT)is calculated in accordance to ASTM D4566 as a power sum on a selected pair from all other pairs as shown in equation for the case of 4-pair connecting hardware.

The summarized test results see table 3.

The required limits were met: **YES**

#### 4.7. Power Sum ACR

The PowerSum ACR is computed from PowerSum NEXT and attenuation as follow:

$$\text{PowerSum ACR} = \text{PowerSum NEXT} - \text{Attenuation}$$

The summarized test results see table 4.

The required limits were met: **YES**

#### 4.8. Return Loss

The return loss was measured from both sides of the link.

The summarized test results see table 4.

The required limits were met: **YES**

#### 4.9. Propagation Delay

The Propagation Delay was measured according to IEC 61935-1.

The summarized test results see table 5.

The required limits were met: **YES**

#### 4.10. Delay Skew

The difference in propagation delay between any two pairs in a channel measured according to IEC 61935-1.

The summarized test results see table 5.

The required limits were met: **YES**

#### 4.11. Resistance

The loop resistance was measured by using a precision LCR meter.

The summarized test results see table 5.

The required limits were met: **YES**

#### 4.12. Remarks about Presentation of Test Results

The detailed test results (parameters vs. frequency) automatically collected by the Microtest OmniScanner were stored as ASCII text files on a personal computer and then imported into an Excel spread sheet file. These data were taken and saved with the continuous limits. For a simple presentation of test results in tables the frequency range 1 MHz to 500 MHz was splitted into some frequency bands. In the tables the worst case limit of each band and the worst case reading of each band is given.

Normally the margin between the readings and the continuous limits is at least equal but normally better than resulting from the tables.

The detailed test results (ASCII text files) are saved by the testing laboratory for later retrieval if necessary.

## 5. List of Test Equipment

| Name            | Model              | Manufacturer | Serial Number | Inventory No. | Last calibration |
|-----------------|--------------------|--------------|---------------|---------------|------------------|
| Link test set   | OMNIScanner2       | Microtest    | 2950-4010-02  | INV292        | 06.2000          |
|                 | OMNIRemote2        | Microtest    | 2950-4011-01  | INV293        | 06.2000          |
| Channel adapter | CHAN 5/5E/6        | Microtest    | 2950-4012-01  | INV313        | 06.2000          |
| Channel adapter | CHAN 5/5E/6        | Microtest    | 2950-4012-01  | INV314        | 06.2000          |
| Link adapter    | TG-Class E Adapter | Telegärtner  | 01            | -             | -                |
| Link adapter    | TG-Class E Adapter | Telegärtner  | 25            | -             | -                |

## Appendices

**Equipment under Test:**

- Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055
- Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.
- Part number 3: M06019A0105
- Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

**Table 1: Summarized Test Results – Max. Attenuation, Next Loss**

| <b>Max. Attenuation [dB]</b> |               | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|------------------------------|---------------|----------------------------------|-------|-------|-------|
| Frequency [MHz]              | Class E Limit | EUT Results                      |       |       |       |
|                              |               | 1-2                              | 3-6   | 4-5   | 7-8   |
| 1.0                          | -4.0          | -2.0                             | -2.1  | -2.1  | -2.0  |
| 4.0                          | -4.2          | -3.9                             | -3.9  | -4.1  | -3.7  |
| 10.0                         | -6.5          | -5.5                             | -5.8  | -5.9  | -5.5  |
| 16.0                         | -8.3          | -6.9                             | -7.1  | -7.3  | -7.0  |
| 20.0                         | -9.3          | -7.7                             | -8.0  | -8.1  | -7.7  |
| 25.0                         | -10.4         | -8.6                             | -8.8  | -9.0  | -8.6  |
| 31.3                         | -11.7         | -9.7                             | -9.8  | -10.0 | -9.6  |
| 62.5                         | -16.8         | -13.9                            | -14.3 | -14.4 | -13.9 |
| 100.0                        | -21.6         | -18.1                            | -18.3 | -18.6 | -18.1 |
| 125.0                        | -24.4         | -20.3                            | -20.6 | -20.8 | -20.2 |
| 155.5                        | -27.4         | -22.7                            | -22.9 | -23.0 | -22.5 |
| 175.0                        | -29.3         | -23.9                            | -24.3 | -24.3 | -24.0 |
| 200.0                        | -31.6         | -25.9                            | -26.5 | -26.2 | -25.9 |
| 250.0                        | -35.7         | -28.8                            | -30.0 | -29.7 | -29.4 |
| 300.0                        | n.a.          | -32.1                            | -33.2 | -32.9 | -31.6 |

| <b>Min. NEXT [dB]</b> |               | ISO/IEC JTC 1/SC 25 N 696 (2001) |         |         |         |         |         |
|-----------------------|---------------|----------------------------------|---------|---------|---------|---------|---------|
| Frequency [MHz]       | Class E Limit | EUT Results                      |         |         |         |         |         |
|                       |               | 1-2/7-8                          | 1-2/3-6 | 1-2/4-5 | 4-5/3-6 | 4-5/7-8 | 3-6/7-8 |
| 1.0                   | -65.0         | -94.4                            | -80.8   | -91.4   | -88.2   | -95.5   | -90.3   |
| 4.0                   | -63.0         | -92.0                            | -77.6   | -85.1   | -78.4   | -90.5   | -87.5   |
| 10.0                  | -56.6         | -92.7                            | -66.4   | -81.7   | -70.1   | -85.0   | -77.8   |
| 16.0                  | -53.2         | -84.7                            | -65.7   | -73.1   | -67.0   | -79.9   | -76.6   |
| 20.0                  | -51.6         | -83.3                            | -63.4   | -71.1   | -64.8   | -79.2   | -74.1   |
| 25.0                  | -50.0         | -80.9                            | -60.3   | -69.6   | -63.2   | -78.8   | -70.7   |
| 31.3                  | -48.4         | -79.9                            | -58.7   | -71.3   | -61.7   | -72.3   | -69.4   |
| 62.5                  | -43.4         | -75.5                            | -52.7   | -65.3   | -56.3   | -62.4   | -61.5   |
| 100.0                 | -39.9         | -71.8                            | -49.4   | -58.5   | -52.5   | -55.8   | -55.7   |
| 125.0                 | -38.3         | -69.1                            | -47.1   | -56.5   | -51.8   | -52.4   | -53.2   |
| 155.5                 | -36.7         | -68.8                            | -45.7   | -57.2   | -48.5   | -49.3   | -49.1   |
| 175.0                 | -35.8         | -67.8                            | -44.6   | -53.5   | -48.8   | -47.4   | -47.3   |
| 200.0                 | -34.8         | -68.3                            | -43.7   | -53.3   | -46.6   | -45.1   | -45.8   |
| 250.0                 | -33.1         | -64.6                            | -41.2   | -50.5   | -42.8   | -42.1   | -43.3   |
| 300.0                 | n.a.          | -63.7                            | -38.8   | -46.9   | -38.0   | -40.0   | -40.1   |



**Equipment under Test:**

- Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055
- Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.
- Part number 3: M06019A0105
- Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

**Table 2: Summarized Test Results – ACR, ELFEXT Loss**

| <b>Min. ACR [dB]</b> |               | <b>ISO/IEC JTC 1/SC 25 N 696 (2001)</b> |                |                |                |                |                |
|----------------------|---------------|---|----------------|----------------|----------------|----------------|----------------|
| Frequency [MHz]      | Class E Limit | EUT Results                             |                |                |                |                |                |
|                      |               | <b>1-2/7-8</b>                          | <b>1-2/3-6</b> | <b>1-2/4-5</b> | <b>4-5/3-6</b> | <b>4-5/7-8</b> | <b>3-6/7-8</b> |
| 1.0                  | -70.4         | -92.5                                   | -78.8          | -89.4          | -86.2          | -93.5          | -88.3          |
| 4.0                  | -58.9         | -88.2                                   | -73.8          | -81.1          | -74.3          | -86.5          | -83.7          |
| 10.0                 | -50.0         | -87.3                                   | -60.6          | -75.9          | -64.2          | -79.2          | -72.1          |
| 16.0                 | -44.9         | -77.8                                   | -58.5          | -65.9          | -59.7          | -72.6          | -69.5          |
| 20.0                 | -42.3         | -75.6                                   | -55.5          | -63.1          | -56.8          | -71.2          | -66.1          |
| 25.0                 | -39.6         | -72.3                                   | -51.5          | -60.6          | -54.3          | -69.8          | -61.9          |
| 31.3                 | -36.7         | -70.3                                   | -48.9          | -61.3          | -51.7          | -62.3          | -59.5          |
| 62.5                 | -26.5         | -61.6                                   | -38.4          | -50.9          | -41.9          | -48.0          | -47.3          |
| 100.0                | -18.3         | -53.8                                   | -31.1          | -40.0          | -34.0          | -37.3          | -37.3          |
| 125.0                | -13.9         | -48.9                                   | -26.5          | -35.8          | -31.2          | -31.7          | -32.6          |
| 155.5                | -9.2          | -46.1                                   | -22.7          | -34.1          | -25.4          | -26.3          | -26.1          |
| 175.0                | -6.5          | -43.9                                   | -20.1          | -29.3          | -24.3          | -23.1          | -22.8          |
| 200.0                | -3.2          | -42.4                                   | -17.3          | -27.1          | -20.2          | -19.0          | -19.4          |
| 250.0                | 2.6           | -35.4                                   | -11.2          | -20.7          | -12.8          | -12.4          | -13.3          |
| 300.0                | n.a.          | -31.7                                   | -5.6           | -14.0          | -4.8           | -7.1           | -6.9           |

| <b>Min. ELFEXT [dB]</b> |               | <b>ISO/IEC JTC 1/SC 25 N 696 (2001)</b> |                |                |                |                |                |
|-------------------------|---------------|---|----------------|----------------|----------------|----------------|----------------|
| Frequency [MHz]         | Class E Limit | EUT Results                             |                |                |                |                |                |
|                         |               | <b>1-2/7-8</b>                          | <b>1-2/3-6</b> | <b>1-2/4-5</b> | <b>4-5/3-6</b> | <b>4-5/7-8</b> | <b>3-6/7-8</b> |
| 1.0                     | -63.3         | -89.3                                   | -84.7          | -82.0          | -82.0          | -85.1          | -88.4          |
| 4.0                     | -51.2         | -91.6                                   | -84.8          | -71.7          | -74.8          | -81.5          | -76.6          |
| 10.0                    | -43.3         | -83.3                                   | -76.8          | -64.1          | -67.4          | -72.9          | -69.6          |
| 16.0                    | -39.2         | -81.8                                   | -73.5          | -60.5          | -63.7          | -69.2          | -65.5          |
| 20.0                    | -37.2         | -80.3                                   | -72.7          | -58.7          | -62.4          | -66.5          | -63.4          |
| 25.0                    | -35.3         | -78.3                                   | -71.2          | -56.4          | -59.7          | -64.8          | -61.6          |
| 31.3                    | -33.4         | -76.2                                   | -68.9          | -53.9          | -56.5          | -63.7          | -60.0          |
| 62.5                    | -27.3         | -71.9                                   | -63.4          | -47.9          | -48.7          | -56.2          | -52.3          |
| 100.0                   | -23.3         | -66.8                                   | -58.6          | -42.3          | -40.9          | -49.4          | -47.9          |
| 125.0                   | -21.3         | -64.2                                   | -57.8          | -41.0          | -38.2          | -47.5          | -45.7          |
| 155.5                   | -19.5         | -60.8                                   | -53.9          | -41.5          | -35.4          | -46.5          | -45.1          |
| 175.0                   | -18.4         | -58.5                                   | -54.1          | -40.7          | -33.6          | -44.4          | -45.1          |
| 200.0                   | -17.2         | -58.4                                   | -50.9          | -40.6          | -31.8          | -43.5          | -41.8          |
| 250.0                   | -15.3         | -54.9                                   | -44.2          | -37.6          | -27.7          | -38.3          | -38.1          |
| 300.0                   | n.a.          | -54.6                                   | -44.3          | -37.4          | -27.6          | -38.0          | -38.2          |

**Equipment under Test:**

- Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055
- Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.
- Part number 3: M06019A0105
- Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

**Table 3: Summarized Test Results - PsumNEXT Loss, PsumELFEXT Loss**

| Min. PsumNEXT [dB] |               | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|--------------------|---------------|----------------------------------|-------|-------|-------|
| Frequency [MHz]    | Class E Limit | EUT Results                      |       |       |       |
|                    |               | 1-2                              | 3-6   | 4-5   | 7-8   |
| 1.0                | -62.0         | -80.3                            | -79.8 | -86.2 | -87.6 |
| 4.0                | -60.5         | -76.8                            | -75.0 | -77.4 | -85.2 |
| 10.0               | -54.0         | -66.4                            | -64.8 | -70.0 | -77.1 |
| 16.0               | -50.6         | -65.2                            | -63.3 | -66.2 | -74.7 |
| 20.0               | -49.0         | -63.1                            | -61.1 | -64.2 | -72.8 |
| 25.0               | -47.3         | -60.0                            | -58.5 | -62.7 | -70.1 |
| 31.3               | -45.7         | -58.6                            | -56.9 | -61.0 | -67.5 |
| 62.5               | -40.6         | -52.5                            | -51.0 | -55.2 | -58.9 |
| 100.0              | -37.1         | -48.9                            | -47.4 | -50.8 | -52.7 |
| 125.0              | -35.4         | -46.6                            | -45.6 | -49.0 | -49.8 |
| 155.5              | -33.8         | -45.5                            | -43.6 | -46.4 | -46.3 |
| 175.0              | -32.9         | -44.1                            | -42.7 | -45.0 | -44.4 |
| 200.0              | -31.9         | -43.3                            | -41.5 | -42.6 | -42.5 |
| 250.0              | -30.2         | -40.7                            | -39.0 | -39.3 | -39.7 |
| 300.0              | n.a.          | -38.2                            | -35.4 | -35.8 | -37.1 |

| Min. PsumELFEXT [dB] |               | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|----------------------|---------------|----------------------------------|-------|-------|-------|
| Frequency [MHz]      | Class E Limit | EUT Results                      |       |       |       |
|                      |               | 1-2                              | 3-6   | 4-5   | 7-8   |
| 1.0                  | -60.3         | -80.1                            | -81.3 | -78.5 | -83.2 |
| 4.0                  | -48.2         | -71.8                            | -72.7 | -69.8 | -75.5 |
| 10.0                 | -40.3         | -64.1                            | -65.1 | -62.3 | -68.3 |
| 16.0                 | -36.2         | -60.8                            | -61.4 | -58.5 | -64.2 |
| 20.0                 | -34.2         | -59.0                            | -59.8 | -56.7 | -62.0 |
| 25.0                 | -32.3         | -56.6                            | -57.5 | -54.4 | -60.1 |
| 31.3                 | -30.4         | -54.2                            | -54.9 | -51.9 | -58.7 |
| 62.5                 | -24.3         | -48.5                            | -47.2 | -45.0 | -51.2 |
| 100.0                | -20.3         | -42.8                            | -40.3 | -38.6 | -46.1 |
| 125.0                | -18.3         | -41.3                            | -37.6 | -36.3 | -43.9 |
| 155.5                | -16.5         | -41.9                            | -35.1 | -34.4 | -43.0 |
| 175.0                | -15.4         | -40.9                            | -33.3 | -32.9 | -42.2 |
| 200.0                | -14.2         | -40.5                            | -31.6 | -31.3 | -41.0 |
| 250.0                | -12.3         | -38.4                            | -27.6 | -27.4 | -37.3 |
| 300.0                | n.a.          | -35.7                            | -24.9 | -25.1 | -34.3 |

**Equipment under Test:**

- Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055
- Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.
- Part number 3: M06019A0105
- Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

**Table 4: Summarized Test Results – PsumACR, Return Loss**

| Min. PsumACR [dB] |               | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|-------------------|---------------|----------------------------------|-------|-------|-------|
| Frequency [MHz]   | Class E Limit | EUT Results                      |       |       |       |
|                   |               | 1-2                              | 3-6   | 4-5   | 7-8   |
| 1.0               | -68.1         | -78.4                            | -81.1 | -84.2 | -85.7 |
| 4.0               | -56.4         | -73.0                            | -79.0 | -73.4 | -81.6 |
| 10.0              | -47.5         | -60.9                            | -61.6 | -64.2 | -71.7 |
| 16.0              | -42.3         | -58.4                            | -64.6 | -58.9 | -67.8 |
| 20.0              | -39.7         | -55.4                            | -59.6 | -56.2 | -65.1 |
| 25.0              | -36.9         | -51.4                            | -53.3 | -53.7 | -61.5 |
| 31.3              | -34.0         | -48.9                            | -52.0 | -51.0 | -57.9 |
| 62.5              | -23.8         | -38.7                            | -40.5 | -40.8 | -45.0 |
| 100.0             | -15.4         | -30.9                            | -33.3 | -32.3 | -34.7 |
| 125.0             | -11.0         | -26.4                            | -28.5 | -28.3 | -29.6 |
| 155.5             | -6.3          | -23.0                            | -23.0 | -23.3 | -23.6 |
| 175.0             | -3.5          | -20.2                            | -19.6 | -20.7 | -20.5 |
| 200.0             | -0.3          | -17.5                            | -15.7 | -16.4 | -16.6 |
| 250.0             | 5.6           | -11.7                            | -9.3  | -9.5  | -10.5 |
| 300.0             | n.a.          | -6.1                             | -2.2  | 0.0   | 0.0   |

| Min. Return Loss [dB] |               | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|-----------------------|---------------|----------------------------------|-------|-------|-------|
| Frequency [MHz]       | Class E Limit | EUT Results                      |       |       |       |
|                       |               | 1-2                              | 3-6   | 4-5   | 7-8   |
| 1.0                   | -19.0         | -26.7                            | -53.0 | -31.1 | -27.5 |
| 4.0                   | -19.0         | -22.8                            | -26.0 | -23.5 | -25.3 |
| 10.0                  | -19.0         | -27.8                            | -33.1 | -28.2 | -29.7 |
| 16.0                  | -18.0         | -32.9                            | -32.7 | -32.4 | -34.9 |
| 20.0                  | -17.5         | -34.8                            | -38.0 | -36.1 | -36.6 |
| 25.0                  | -17.0         | -38.6                            | -40.9 | -39.2 | -36.5 |
| 31.3                  | -16.5         | -27.4                            | -34.1 | -26.5 | -29.1 |
| 62.5                  | -14.0         | -36.2                            | -38.1 | -36.8 | -34.4 |
| 100.0                 | -12.0         | -36.2                            | -32.3 | -30.8 | -36.0 |
| 125.0                 | -11.0         | -33.4                            | -32.9 | -34.5 | -28.6 |
| 155.5                 | -10.1         | -31.4                            | -40.2 | -37.9 | -26.2 |
| 175.0                 | -9.6          | -29.5                            | -31.9 | -26.7 | -30.5 |
| 200.0                 | -9.0          | -33.9                            | -28.6 | -28.6 | -23.4 |
| 250.0                 | -8.0          | -32.5                            | -29.8 | -34.5 | -23.1 |
| 300.0                 | n.a.          | -30.5                            | -27.4 | -21.5 | -22.2 |

**Equipment under Test:**

- Part number 1: J00020B0332(1x) electrically identical to  
J00020B0333, J00020B0334, J00020B0380, J00020B0336,  
J00023B0052, J00023B0053, J00023B0054, J00023B0055
- Part number 2: J02023A0019(1x) electrically identical to  
J02023B0019, J02023C0019, J02023D0019, J02023E0019,  
J02022A0028, J02021A0015, J02021A0017, J02022A0019.
- Part number 3: M06019A0105
- Installation cable: 90m Leoni Q-Line 4P23 SC300 FRNC, Order No.87501342H  
Individual Foil and Braid Screened Category 6 EN & ISO/IEC  
Communication Cable in LSFROH Version. Fire Retardancy  
according to IEC 60332-3, Cat. C.

**Table 5: Summarized Test Results – Delay, Skew, DC Resistance**

| <b>Propagation Delay [ns]</b> |         | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|-------------------------------|---------|----------------------------------|-------|-------|-------|
| Frequency                     | Class E | EUT Results                      |       |       |       |
| [MHz]                         | Limit   | 1 - 2                            | 3 - 6 | 4 - 5 | 7 - 8 |
| 10.0                          | 555     | 421.0                            | 420.0 | 422.0 | 418.0 |

| <b>Delay Skew [ns]</b> |         | ISO/IEC JTC 1/SC 25 N 696 (2001) |  |
|------------------------|---------|----------------------------------|--|
| Frequency              | Class E | EUT Results                      |  |
| [MHz]                  | Limit   |                                  |  |
| 10.0                   | 50      | 4.0                              |  |

| <b>Max. DC Resistance [Ohm]</b> |         | ISO/IEC JTC 1/SC 25 N 696 (2001) |       |       |       |
|---------------------------------|---------|----------------------------------|-------|-------|-------|
| Frequency                       | Class E | EUT Results                      |       |       |       |
| [MHz]                           | Limit   | 1 - 2                            | 3 - 6 | 4 - 5 | 7 - 8 |
| DC/1 kHz                        | 40      | 17.2                             | 16.8  | 18.1  | 16.9  |