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Date  
2011-12-27

Reference  
PX18198-04

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AB Micropol Fiberoptic

313 50 ÅLED

## Test of fiber connectors

(1 appendix)

### Introduction

Fiber connectors of the LC/UPC type, mounted on 2 m long patchcords of G657 fiber, have been evaluated with respect to requirements set by TeliaSonera. The result is that the connectors fulfil the requirement on all parameters that are tested.

### Identification

Objects	15 connectorized 2 m long G657 fiber patchcords, with LC/UPC connectors on both ends, ID.numbered LCUPC i, where i runs from 31 to 60
Object state	Upon arrival the objects had no visual damages.
Received date	2011-12-07
Measurement place	Borås
Measurement date	2011-12-07 to 2011-12-22

### Measurement methods and procedures

The objects were measured according to the instructions in TeliaSonera specification 1056-A 166 "Requirements for Optical Connector and Adaptor type LC/PC for Single Mode Fibre". The performed tests are 4.1 Visual Inspection, 4.3.2 Attenuation of random mated connectors, 4.4 Return Loss of random mated connectors, 4.6 Bending moment, 4.7 Cable pulling and 4.8 Torsion. The results are compared with the requirements below, and detailed measurement data is attached in appendix.

#### 4.1 Visual Inspection , 4.1.2 Inspection of end face

The end face of the connectors were inspected to be free from residues of glue. Study in fiber microscope to look for scratches or break out glass pieces on the fiber face.

Sample size: 20 connectors

Requirement: No residue, no scratches or break out glass pieces on fiber face

#### 4.3 Attenuation, 4.3.2 Attenuation of random mated connectors

Setup and measurement according to IEC 61300-3-34, method 1. The used adaptors are previously verified to fulfil requirements, and are not covered by this study.

Sample size: 20 connectors

Requirement: mean  $\leq 0,25$  dB, max  $\leq 0,50$  dB

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#### 4.4 Return Loss, 4.4.1 Coupler Method

The measurement equipment operates according to IEC 61300-3-6 §4.1 method B. The reference return loss is achieved from attenuating the light through the fiber, enabling measurements up to 60 dB.

Sample size: 20 connectors

Requirement:  $RL \geq 50$  dB, all connector matings

#### 4.5 Bending Moment

Measurement according to IEC 61300-2-7, applying 10 N at a position 25 mm from the center line defined by the optical interface. Full load applied for >10 s

Sample size: 4 connector sets

Requirement: allowable attenuation variation  $\leq 0,20$  dB, allowable return loss  $\geq 50$  dB

#### 4.6 Cable Pulling

Measurements according to IEC 61300-2-4, applying 5 N at a position 0,3 m from the end face of the connector. Full load applied for 60 s.

Sample size: 4 connector sets

Requirement: allowable attenuation variation  $\leq 0,20$  dB, allowable return loss  $\geq 50$  dB

#### 4.7 Torsion

Measurement according to IEC 61300-2-5, applying 2 N at a position 0,2 m from the end face of the connector. Keeping the connector fixed and turning the cable  $\pm 180$  degrees in 25 cycles.

Sample size: 4 connector sets

Requirement: allowable attenuation variation  $\leq 0,20$  dB,

Test	DUTs	Results	Conclusion
4.1 Visual Inspection 4.1.2 Inspection of end face	Connectors: 01 to 20	No residues of glue, no scratches or break out glass pieces were found.	Pass
4.3 Attenuation 4.3.2 Random mated connectors	Connectors 01 to 20	Mean attenuation = 0,09 dB Max attenuation = 0,36 dB	Pass
4.4 Return Loss 4.4.1 Coupler Method	Connectors 01-20	All connector mating experienced $\geq 60$ dB	Pass
4.5 Bending moment	Connectors 23-26. 29-30	Max atten variation = 0,12 dB $RL \geq 60$ dB at all times	Pass
4.6 Cable Pulling	Connectors 21 – 26	Max atten variation = 0,03 dB $RL \geq 50$ dB at all times	Pass
4.7 Torsion	Connectors 23 – 26, 29	Max atten variation = 0,01 dB $RL \geq 50$ dB at all times	Pass

The results relate only to the objects, which are specified in this document.

## Measurement conditions

Room temperature	23 ±1 °C
Instruments	Turned on > 1 hour before measurements
Wavelength	1550 nm

## Conclusion

The measurements verify that the connectors evaluated in this study fulfils the requirement of the parameters tested, as specified in the document 1056-A 166

## Measurement uncertainty

Attenuation: ± 0.01 dB

Wavelength: ± 0,5 nm

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with EA Publication EA-4/02 (formerly EAL-R2). The long term stability of the calibrated object is not included in the reported expanded uncertainty of measurement.

## Traceability

SP is National Laboratory for photometric and optical radiometric quantities by appointment of the Swedish government. The unit for the quantity radiant flux is realized at wavelengths of different laser lines from the definition of electrical voltage and electric resistance by use of a cryogenic electrical substitution radiometer. All used standards and instruments are calibrated regularly.

## Equipment

Optical Return Loss Meter: JDSU cORL-A1, SN: BN2298/23

Multifunction Loss Tester: EXFO FOT-930, SN: 478437

## SP Technical Research Institute of Sweden Measurement Technology - Communication

Performed by

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## Appendix

Appendix 1

Connector	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	51	52
31			7	6	9	6	9	17	16	12	16	7	10	12	7	8	13	9	9	13
32			0	1	11	2	8	6	1	3	1	2	0	1	1	0	1	2	4	5
33					10	21	9	7	4	15	16	17	1	10	7	17	18	15	3	4
34					13	11	1	24	14	18	21	22	2	16	6	14	15	11	3	2
35							36	18	11	3	5	8	18	21	3	2	5	5	6	4
36							7	17	15	9	11	7	8	12	3	8	14	2	6	5
37									15	4	6	2	18	0	4	3	7	7	12	4
38									4	6	14	17	8	15	2	4	5	7	1	1
39											20	23	14	21	12	14	10	23	1	5
40											20	21	8	12	15	16	20	15	1	1
41													2	15	15	18	15	6	2	6
42													13	12	5	8	13	1	4	1
43															3	7	5	4	11	14
44															5	12	15	4	2	5
45																	15	7	4	1
46																	15	14	2	1
47																			5	5
48																			8	6
51																				
52																		Average	0,089722	
																		Max	0,36	

All measured data are in 0,01 dB for clarity, Average and Max value are given in dB

RL are > 60 dB in all datapoints

Torsion	B	D	A	Mating connector
51	0	0	0	53
52				
53	0	1	0	51
54	0	0	0	51
55	0	1	0	51
56	0	0	0	51
Bending	during	after = during or less		
51	0			53
52	0			54
53	3			51
54	12			52
57	1			51
58	6			51
Pulling	53	54	55	56
51	0	3	0	0
52	1	0	0	0
53			0	0
54			0	2
	during	after = during or less		