

# ISO 21111-4:2020-03 (E)

## Road vehicles - In-vehicle Ethernet - Part 4: General requirements and test methods of optical gigabit Ethernet components

---

<b>Contents</b>		<b>Page</b>
Foreword .....		v
Introduction .....		vii
1	Scope .....	1
2	Normative references .....	1
3	Terms and definitions .....	2
4	Abbreviated terms .....	3
5	1000BASE-RHC components .....	4
6	Header connector .....	5
6.1	Dimension criteria .....	5
6.2	Mechanical coding .....	8
6.3	Requirements of header connector .....	9
6.4	Evaluation .....	10
6.4.1	High storage temperature exposure .....	10
6.4.2	Low storage temperature exposure .....	10
6.4.3	Operating temperature range .....	11
7	Cable connector .....	11
7.1	Cable plug .....	11
7.1.1	Dimension criteria .....	11
7.1.2	Mechanical coding .....	13
7.2	Cable socket .....	13
7.2.1	Dimension criteria .....	13
7.2.2	Mechanical coding .....	16
7.3	Requirements of cable connector .....	16
7.4	Evaluation .....	16
7.4.1	High storage temperature exposure .....	16
7.4.2	Low storage temperature exposure .....	17
7.4.3	Operation temperature range (informative) .....	17
8	POF and POF cable .....	17
8.1	POF .....	17
8.2	Requirements of POF .....	17
8.3	Outline of POF .....	18
8.3.1	Cladding diameter .....	18
8.3.2	Numerical aperture .....	18
8.3.3	Attenuation .....	19
8.4	POF cable .....	20
8.5	Requirements of POF cable .....	21
8.6	Evaluation .....	22
8.6.1	High storage temperature exposure .....	22
8.6.2	Low storage temperature exposure .....	22
8.6.3	Operation temperature range .....	23
8.6.4	Minimum bending radius .....	23
8.6.5	Maximum bending attenuation .....	24

8.6.6	Tensile strength .....	25
8.6.7	Crush .....	26
8.6.8	Edge impact .....	27
8.6.9	Static torsion .....	28
8.6.10	Resistance to flame propagation .....	29
9	Optical channel .....	30
9.1	General .....	30
9.2	Optical harness (informative) .....	30
9.3	Positions of test points .....	31
9.4	Requirements .....	31
9.4.1	Electrical characteristics .....	31
9.4.2	Optical characteristics .....	32
9.4.3	Physical characteristics .....	32
9.4.4	Temperature environmental characteristics .....	33
9.4.5	Combined environment examination .....	33
9.4.6	Specific environmental examination .....	33
9.5	Methodology (informative) .....	34
9.5.1	Light source setup .....	34
9.5.2	Excitation, test setup and measurement equipment .....	34
9.5.3	Harness setup .....	35
9.6	Evaluation (characteristics of photoelectric conversion) .....	36
9.6.1	Optical PMD transmitter input electrical interface .....	36
9.6.2	Optical PMD receiver output electrical interface .....	38
9.7	Evaluation (optical characteristics) .....	40
9.7.1	Minimum average output power at TP2 .....	40
9.7.2	Extinction ratio at TP2 .....	40
9.7.3	EAF profile at TP2 .....	41
9.7.4	Minimum average output power at TP2' .....	41
9.7.5	Minimum average output power at TP3 .....	43
9.7.6	Range of optical input power at TP3' .....	43
9.7.7	Maximum coupling attenuation at optical in-line .....	45
9.8	Evaluation (physical characteristics) .....	46
9.8.1	Minimum retention force .....	46
9.8.2	Maximum insertion force .....	47
9.8.3	Maximum unlock and release force .....	48
9.8.4	Durability of repeated mating and unmating .....	48
9.8.5	Maximum cable holding force .....	49
9.9	Evaluation (temperature environmental characteristics) .....	49
9.9.1	High storage temperature exposure .....	49
9.9.2	Low storage temperature exposure .....	50
9.9.3	High operation temperature exposure .....	50
9.9.4	Low operation temperature exposure .....	51
9.10	Evaluation (combined environmental examination) .....	51
9.10.1	General .....	51
9.10.2	Flow chart of environmental load tests for optical PMD transmitter .....	51
9.10.3	Operation test after durability of mate and un-mate .....	52
9.10.4	Operation test after high temperature exposure .....	52
9.10.5	Operation test after temperature and vibration .....	53
9.10.6	Operation test after heat shock .....	53
9.10.7	Operation test after humidity/temperature cycle procedure .....	54
9.10.8	Operation test after specific vibration profile .....	54
9.10.9	Requirement of combined environmental examination .....	54
9.11	Evaluation (specific environmental examination) .....	55
9.11.1	General .....	55
9.11.2	Individual environmental load tests for optical harness .....	55
9.11.3	Operation test after specific physical impact .....	55
9.11.4	Operation test after chemical durability procedure .....	55
9.11.5	Operation test after Noxious gas exposure .....	56
9.11.6	Operation test after specific dust condition exposure .....	56
9.11.7	Operation test after specific drop procedure .....	56

**9.11.8 Requirements of specific environmental examination .....57**  
**Annex A (informative) System power budget ..... 58**  
**Annex B (informative)Modelfilter ..... 60**  
**Bibliography .....62**