#### ANNEXURES TO ER FOR OPTICAL FIBRE CABLE

**Annexure-Tx-A1-OFC:** Optical Fibre Cable for Duct Applications (Duct, Micro Duct)

**Annexure-Tx-A2-OFC:** Optical Fibre Cable for Direct Buried application

**Annexure-Tx-A3-OFC:** Optical Fibre Cable for Aerial Applications

(ADSS Over Power Line, ADSS on Aerial alignment, Lashed Aerial Cable and

Optical Ground Wire-OPGW)

**Annexure-Tx-A4-OFC:** Optical Fibre Cable for Access Network Applications

(Indoor Cable, Outdoor Cable, Riser Cable, Indoor/Outdoor Cable, In-Home

Cable)

**Annexure-Tx-A5-OFC:** Optical Fibre Cable for Direct Surface Application (DSA)

**Annexure-Tx-A6-OFC:** Hybrid Cable (Optical and Metallic)

## **Annexure-Tx-A1-OFC:** Optical Fibre Cables for Duct Application (Duct, Micro-duct)

#### **A1.1 Parameter Group:** Optical Fibre Cables- Duct

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and	< 0.36 dB/Km	Applicable to respective
	Characteristics		IEC 60793-2-50, 60793-1-40,	_ 0.50 dB/12.11	type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	≤ 0.3 ps/√km	Do
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 1.5W Newton or 2670 N whichever is higher (W-mass of 1 Km of cable in Kg).	

10	Crush Resistance	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Compressive load of 1500 N/2200 N	1500 N (for Un-armoured) 2200 N (for Armoured)
11	Impact	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Impact of 20Nm	20 Nm for both Unarmoured cable and Armoured cable. 10 impacts shall be applied at the surface with the radius of 300mm.
12	Kink Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14	Repeated Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg with	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsion Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable Drip Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.

17		Abrasion Resistance Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.	
18	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C. TB1 temperature: + 60°C. TB2 temperature: + 70°C. No. of temperature cycle: 2 Time at each temperature: 12hrs.	
19		Cable Aging test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: $\leq$ 0.05dB, when cable is exposed to 85 °C $\pm$ 2 °C for a minimum of 168 hours.	
20		Water Blocking Test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
21		UV Radiation Test	IEC 60068-2-1, ISO4892-2, ASTM G-154-12a, IEC 60794-1-22 Method F14,	Type of lamp: 40watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours There should not be any fading or change in colour of the sheath.	
22		Lightning Test	FOTP-181, ITU-T K-47	The cable shall withstand the current level of ≥105 K Amp. There	Applicable for Armoured cable.

23	Termite and Roder Test		shall not be any damage to the fibre & Inner Sheath of the cable and change in attenuation of the fibre after the test shall be ≤ 0.05 dB for 1550 nm.  Following minimum parametric test for Anti-termite dopant shall be carried out - Non- toxicity - Thermal Stability - Long life span/half-life - Efficacy	No Indian/Global standard. One similar standard is under draft stage in IEC. This test may be taken up as per IEC, once IEC finalises its standard.
24	Check of the effect aggression media of the cable	on	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables. The sample should not show any effect of these solutions on the sheath and other marking of the cable	
25	Cable Material Compatibility	Telecordia GR 20, IEC 60794-3-11	Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all raw materials are same in one of the cable design, then this test shall be skipped based on prior result.
26	Electrical continuit	y IEC 60794-1-24, IEC 60794- 3-11	The metallic elements shall be continuous.	Applicable for Armoured cable.
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27	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
28	(50000)	Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
29		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
30		Strippability test - Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
31		Strippability test - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	Applicable for Micromodule only.
32	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
33	Elements	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	- Breakout shall be accomplished without specialized tools or apparatus.	Applicable for Ribbon Fibre Only

	(Ribboned Fibre)			- The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;	
				- Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.	
34		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 500 N.	Applicable for Ribbon Fibre Only
35		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 500 N.	Applicable for Ribbon Fibre Only
36		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 500 N.	Applicable for Ribbon Fibre Only
37		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation at 1550 nm : ≤ 0.05 dB when wrapped on a 60 mm diameter mandrel for 100 turns	Applicable for Ribbon Fibre Only
38		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre Only
39	Geometrical Characteristics of Fibre used in the cable	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
40		Cladding Diameter	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
41		Cladding Non- circularity	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
42		Core Clad concentricity error	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
43		Coating diameter Coating /Cladding concentricity	IEC 60793-2-50, 60793-1-21, IEC 60793-2-50, 60793-1-21,	Do Do	Do Do

45	Transmission	At 1550nm	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics of		IEC 60793-2-50, 60793-1-42,	TEC70012008 for respective type	type of Optical fibre used in
	Fibre used in the			of Optical fibre used in the cable	the cable as per ITU-T
	Cable (Chromatic			-	G.65x
46	Dispersion)	At 1625nm	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
47		In 1285-1330nm band	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
48		In 1270-1340nm band	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
49		Zero Dispersion slope	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
50		Zero Dispersion	ITU-T G.65x, G.650.1 and		
		wavelength range	IEC 60793-2-50, 60793-1-42,	Do	Do
51	Transmission	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	when fiber is coiled	IEC 60793-2-50 and IEC	TEC70012008 for respective type	type of Optical fibre used in
	of Fibre used in	with 100 turns on 60	60793-1-47,	of Optical fibre used in the cable	the cable as per ITU-T
	the cable	±1.0 mm diameter			G.65x
	(Fibre Macro	mandrel			
52	bend loss)	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,		
		when fiber is coiled	IEC 60793-2-50 and IEC	Do	Do
		with 1 turn around 32	60793-1-47,		
		$\pm$ 0.5 mm diameter			
		mandrel			
53		Change in attenuation	ITU-T G.652.D ,ITU-T	As per Annexure to TEC ER No:	Applicable to respective
		when fiber is coiled	G.650.1, IEC 60793-2-50 and	TEC70012008 for G.652.D type of	type of Optical fibre used in
		with 100 turns on 50	IEC 60793-1-47,	Optical fibre used in the cable	the cable as per ITU-T
		±0.5 mm diameter			G.652.D
		mandrel			
54		Change in	ITU-T G.657.A, G.650.1 IEC	As per Annexure to TEC ER No:	Applicable to respective
		attenuation when	60793-2-50,	TEC70012008 for G.657.A1 &	type of Optical fibre used in
		fibre is coiled with	60793-1-47	G.657.A2 type of Optical fibre used	the cable as per ITU-T
		10 turns on 15 mm		in the cable	G.652.A
		radius mandrel			
		radius manarei			

55		Change in attenuation when fibre is coiled with 1 turn on 10 mm radius mandrel	ITU-T G.657. A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
56		Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
57		Change in attenuation when fibre is coiled with 1 turn on 5 mm radius mandrel	ITU-T G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.B
58	Mechanical Characteristics of Fibre used in the cable	Peak Stripability force to remove primary coating of the fiber (Unaged, Water aged, Damp heat aged)	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
59		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
60	Colour qualification for color fibres	MEK RUB Test (Methyl Ethyl Ketone)	Draft IEC 60794-1-219,	Do	Do
61	Safety Requirement	The material used in the manufacturing of the OFC shall be nontoxic and dermatologically safe in its life time and shall not be hazardous to health.		The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of Optical fibre cable to substantiate the requirement.	

## **A1.2 Parameter Group:** Optical Fibre Cables- Micro Duct

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	≤ 0.3 ps/√km	Do
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 1.3 W Newton or 300 N whichever is higher (Wmass of 1 Km of cable in Kg).	
10		Crush Resistance	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB.when subjected to a compressive load of 1000 N	

11	Impact	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB.when subjected to Impact of 12.5 Nm	
12	Kink Test	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend Test	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14	Repeated Bend Test	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D-diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsion Test	IEC 60794-1-21, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable Drip Test	IEC 60794-1-21, 60794-5-10,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.

17		Abrasion Resistance Test	IEC 60794-1-21, 60794-5-10,	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.	
18	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C. TB1 temperature: + 60°C. TB2 temperature: + 70°C. No. of temperature cycle: 2 Time at each temperature: 12hrs.	
19		Cable Aging test	IEC 60794-1-22, 60794-5-10,	Change in attenuation at 1550nm: ≤ 0.05dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
20		Water Blocking Test	IEC 60794-1-22, 60794-5-10,	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.

21	UV Radiation Test	IEC 60068-2-1, ASTM G-154-	Type of lamp: 40watt UV-B	
		12a, IEC 60794-1-22 Method	lamp with peak emission at	
		F14,	313nm.	
			Duration: 2000 hours	
			There should not be any fading	
			or change in colour of the	
			sheath.	
22	Termite and Rodent Test		Following minimum parametric	No Indian/Global standard.
			test for Anti-termite dopant shall	One similar standard is under
			be carried out	draft stage in IEC forum.
			- Non- toxicity	This test maybe taken up as
			- Thermal Stability	per IEC, once IEC finalises
			- Long life span/half-life	its standard.
			- Efficacy	
23	Check of the effect of	ISO175	The test samples are put in the	
	aggression media on the		PH4 and PH10 solutions	
	cable		separately. After 30 days these	
			samples are taken out from the	
			solutions and examined for any	
			corrosion etc. on the sheath and	
			other markings of the cables.	
			The sample should not show any	
			effect of these solutions on the	
			sheath and other marking of the	
			cable	
24	Cable Material	Telecordia GR 20, IEC 60794-	Optical fibre, buffers/core tubes,	Applicable as per IEC
	Compatibility	3-11	and other core components shall	60794-1-219 (draft) to
			meet the requirements of the	control the quality of
			compatibility with buffer/core	material and life span of the
			tube filling material(s) and/or	cable.
			water-blocking materials that are	If all RM are same in one of
			in direct contact with identified	the cable design, then this
			components within the cable	test shall be skipped based on
			structure	prior result.

25	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
26		Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
27		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
28		Strippability and access to the fiber – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
29		Strippability and access to the fiber - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	Applicable for Micromodule only.
30	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
31	Elements	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	- Breakout shall be accomplished without specialized tools or apparatus.	Applicable for Ribbon Fibre Only

	(D'11 1			The fibre breedvent are sedune	
	(Ribboned			- The fibre breakout procedure	
	Fibre)			shall not be permanently	
				detrimental to the fibre optical	
				and mechanical performance;	
				- Any colour coding of fibres	
				shall remain sufficiently intact	
				to enable individual fibres to be	
				distinguished from each other.	
32		Ribbon Compression	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
		Resistance		subjected to a compressive load	Only
				of 500 N at 1550nm: $\leq 0.05$ dB.	•
33		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
			,	subjected to a compressive load	Only
				of 500 N at 1550nm: $\leq 0.05$ dB.	
34		Ribbon Torsion	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
		Resistance	,	subjected to a compressive load	Only
				of 500 N at 1550nm: $\leq 0.05$ dB.	
35	-	Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
				wrapped on a 60 mm diameter	Only
				mandrel for 100 turns at 1550 nm	
				0.05  dB	
36		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre
		and the property and th			Only
37	Geometrical	Mode Field Diameter at	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER	Applicable to respective type
	Characteristics	1310 nm/1550nm	IEC 60793-2-50, 60793-1-45	No: TEC70012008 for	of Optical fibre used in the
	of Fibre used in		,	respective type of Optical fibre	cable as per ITU-T G.65x
	the cable			used in the cable	r
38	1	Cladding Diameter	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-20,	Do	Do
39		Cladding Non-circularity	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-20,	Do	Do
40	]	Core Clad concentricity	ITU-T G.65x, G.650.1 and		
		error	IEC 60793-2-50, 60793-1-20,	Do	Do
41	]	Coating diameter	IEC 60793-2-50, 60793-1-21,		
				Do	Do

42		Coating /Cladding	IEC 60793-2-50, 60793-1-21,		
		concentricity		Do	Do
43	Transmission Characteristics of Fibre used in the Cable (Chromatic	At 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
44	Dispersion)	At 1625nm	ITU-T G.65x, G.650.1 and	_	
			IEC 60793-2-50, 60793-1-42,	Do	Do
45		In 1285-1330nm band	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
46		In 1270-1340nm band	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
47		Zero Dispersion slope	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
48		Zero Dispersion wavelength range	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
49	Transmission	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER	Applicable to respective type
	Characteristics	when fiber is coiled with	IEC 60793-2-50 and IEC	No: TEC70012008 for	of Optical fibre used in the
	of Fibre used in	100 turns on $60 \pm 1.0$ mm	60793-1-47,	respective type of Optical fibre	cable as per ITU-T G.65x
	the cable	diameter mandrel		used in the cable	
50	(Fibre Macro bend loss)	Change in attenuation when fiber is coiled with 1 turn around $32 \pm 0.5$ mm diameter mandrel	ITU-T G.65x ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793-1-47,	Do	Do
51		Change in attenuation	ITU-T G.652.D ,ITU-T	As per Annexure to TEC ER	Applicable to respective type
		when fiber is coiled with 100 turns on $50 \pm 0.5$ mm diameter mandrel	G.650.1, IEC 60793-2-50 and IEC 60793-1-47,	No: TEC70012008 for G.652.D type of Optical fibre used in the cable	of Optical fibre used in the cable as per ITU-T G.652.D
52		Change in attenuation when fibre is coiled with 10 turns on 15 mm radius mandrel	ITU-T G.657.A, G.650.1 IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A1 & G.657.A2 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A
53		Change in attenuation when fibre is coiled with	ITU-T G.657. A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 &	Applicable to respective type of Optical fibre used in the

	-		T	1	
		1 turn on 10 mm radius		G.657.B3 type of Optical fibre	cable as per ITU-T G.652.A
		mandrel		used in the cable	& G.657.B
54		Change in attenuation	ITU-T G.657.A & G.657.B,	As per Annexure to TEC ER	Applicable to respective type
		when fibre is coiled with	G.650.1 and IEC 60793-2-50,	No: TEC70012008 for	of Optical fibre used in the
		1 turn on 7.5 mm radius	60793-1-47,	G.657.A2 & G.657.B3 type of	cable as per ITU-T G.652.A
		mandrel		Optical fibre used in the cable	& G.657.B
55		Change in attenuation	ITU-T G.657.B, G.650.1 and	As per Annexure to TEC ER	Applicable to respective type
		when fibre is coiled	IEC 60793-2-50,	No: TEC70012008 for	of Optical fibre used in the
		with 1 turn on 5 mm	60793-1-47	G.657.B3 type of Optical fibre	cable as per ITU-T G.657.B
		radius mandrel		used in the cable	
56	Mechanical	Peak Stripability force to	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER	Applicable to respective type
	Characteristics	remove primary coating		No: TEC70012008 for	of Optical fibre used in the
	of Fibre used in	of the fiber (Unaged,		respective type of Optical fibre	cable as per ITU-T G.65x
	the cable	Water aged, Damp heat		used in the cable	_
		aged)			
57		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
58	Colour	MEK RUB Test	Draft IEC 60794-1-219,	Do	Do
	qualification for	(Methyl Ethyl Ketone)			
	color fibres				
59	Safety	The material used in the		The manufacturer shall submit	
	Requirement	manufacturing of the OFC		MSDS (Material safety Data	
		shall be non-toxic and		Sheet) for all the material used in	
		dermatologically safe in		manufacturing of Optical fibre	
		its life time and shall not		cable to substantiate the	
		be hazardous to health.		requirement.	
				_	

# **Annexure-Tx-A2-OFC: Optical Fibre Cables for Direct Buried Application**

## **A2.1 Parameter Group:** Optical Fibre Cable- Direct Buried

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	≤ 0.3 ps/√km	Do
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 1.5W Newton or 3000 N whichever is higher (W-mass of 1 Km of cable in Kg).	

10	Crush Resistance	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB.when subjected to a	2500 N (for Un-armoured cable)
			compressive load of 2500/3500 N	3500 N (for Armoured cable)
11	Impact	IEC 60794-1-21, 60794-3,	Change in attenuation at 1310 &	25 Nm for both Unarmoured
		60794-3-10, 60794-3-11,	$1550$ nm: $\leq 0.05$ dB.when	cable and Armoured cable.
			subjected to Impact of 25Nm	10 impacts shall be applied at
				the surface with the radius of
				300mm.
12	Kink Test	IEC 60794-1-21, 60794-3,	Change in attenuation at 1550nm:	There shall be no damage to
		60794-3-10, 60794-3-11,	$\leq$ 0.05dB when subjected to a Kink	the sheath or to the cable
			with radius of 10D (D - diameter	elements under visual
			of cable).	examination without
13	Bend Test	IEC 60794-1-21, 60794-3,	Change in attenuation at 1550nm:	magnification
13	Delia Test	60794-3-10, 60794-3-11,	≤ 0.05dB when subjected to Bend	
		00794-3-10, 00794-3-11,	around a mandrel of diameter of	
			20D for 10 cycles.	
14	Repeated Bend Test	IEC 60794-1-21, 60794-3,	Change in attenuation at 1550nm:	The bending rate shall be
		60794-3-10, 60794-3-11,	$\leq$ 0.05dB when cable is flexed with	approximately one cycle in
			1 cycle in 2 sec to 5 sec with	2s to 5s and cable shall be
			Pulley diameter of 20D (D-	free from any optical &
			diameter of cable) and Load of	visual physical damage.
			5Kg	
15	Torsion Test	IEC 60794-1-21, 60794-3,	Change in attenuation at 1550nm:	Cable shall be free from any
		60794-3-10, 60794-3-11,	$\leq$ 0.05dB when subjected to	optical & visual physical
			Torsion with a load of 100N for	damage.
		WG 40 <b>5</b> 0444 <b>0</b> 4 505045	10 cycles.	
16	Cable Drip Test	IEC 60794-1-21, 60794-3,	Sample is kept vertically with open	Not applicable for Dry-Dry
		60794-3-10, 60794-3-11,	end downwards in the oven for 24	Cable Design.
			hours at 70° C and examine the	
			paper placed below the cable for	
			dripping of the jelly after 24 hours.	
			There should be no jelly drip or	
			oily impression on the paper.	

17		Abrasion Resistance Test	IEC 60794-1-21, 60794-3,	Steel needle diameter $d = 1.0 \text{ mm}$ ,	
			60794-3-10, 60794-3-11,	load: 4 N	
			,	No perforation & loss of legibility	
				of the marking on the sheath.	
18	Environmental	Temperature Cycling	IEC 60794-1-22, 60794-3,	Change in attenuation at 1550nm:	
	Characteristics	T T T T T T T T T T T T T T T T T T T	60794-3-10, 60794-3-11	$\leq 0.05$ dB when subjected to	
				following temperature cycle:	
				TA2 temperature: - 20°C	
				TA1 temperature: - 10°C.	
				TB1 temperature: + 60°C.	
				TB2 temperature: + 70°C.	
				No. of temperature cycle: 2	
				Time at each temperature : 12hrs.	
19		Cable Aging test	IEC 60794-1-22, 60794-3,	Change in attenuation at 1550nm:	
			60794-3-10, 60794-3-11	$\leq 0.05$ dB, when cable is exposed	
				to 85 °C $\pm$ 2 °C for a minimum of	
				168 hours.	
20		Water Blocking Test	IEC 60794-1-22, 60794-3,	Test duration: 168 hour	No water shall be detected at
			60794-3-10, 60794-3-11	Sample length: 3 m	the unsealed end of the
				Water Head Height: 1m	sample. If a fluorescent dye
				No dye shall be detected when the	is used, an ultraviolet light
				end of the 3m length is examined	may be used for the
				with ultraviolet light detector. The	examination.
				cable sample under test for 7	
				days, shall be ripped open after	
				the test and then it shall be	
				examined for seepage of water	
				into the cable and it shall not be	
21		TAND 1: 4: TE 4	TEC (00(0 2 1 ACT) A C 174	more than 20 cm.	
21		UV Radiation Test	IEC 60068-2-1, ASTM G-154-	Type of lamp: 40watt UV-B lamp	
			12a, IEC 60794-1-22 Method	with peak emission at 313nm. Duration: 2000 hours	
			F14,		
				There should not be any fading or	
	1			change in colour of the sheath.	

22	Termite and Rodent Test		Following minimum parametric test for Anti-termite dopant shall be carried out - Non- toxicity - Thermal Stability - Long life span/half-life - Efficacy	No Indian/Global standard. One similar standard is under draft stage in IEC forum. This test maybe taken up as per IEC, once IEC finalises its standard.
23	Check of the effect of aggression media on the cable	ISO175	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables. The sample should not show any effect of these solutions on the sheath and other marking of the cable	
24	Cable Material Compatibility	Telecordia GR 20, IEC 60794-3-11	Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all RM are same in one of the cable design, then this test shall be skipped based on prior result.
25	Lightning Test	FOTP-181, ITU-T K-47	The cable shall withstand the current level of greater than 105 K. Amp. There shall not be any damage to the fibre & Inner Sheath of the cable and change in attenuation of the fibre after the test shall be < 0.05 dB for 1550 nm.	Applicable for Armoured cable.

26		Electrical continuity test	IEC 60794-1-24, IEC 60794-	The metallic elements shall be	Applicable for Armoured
			3-11	continuous.	cable.
27	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
28		Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
29		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
30		Strippability and access to the fiber – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
31		Strippability and access to the fiber - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	Applicable for Micromodule only.
32	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
33	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	- Breakout shall be accomplished without specialized tools or apparatus.	Applicable for Ribbon Fibre Only

	I		1	T	1
				- The fibre breakout procedure	
				shall not be permanently	
				detrimental to the fibre optical	
				and mechanical performance;	
				- Any colour coding of fibres shall	
				remain sufficiently intact to	
				enable individual fibres to be	
				distinguished from each other.	
34		Ribbon Compression	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
		Resistance	,	subjected to a compressive load of	Only
				$500 \text{ N at } 1550 \text{nm} \le 0.05 \text{dB}.$	
35		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
				subjected to a compressive load of	Only
				500 N at 1550nm: ≤ 0.05dB.	
36		Ribbon Torsion	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
		Resistance	Ee 60751 1 51, Ee 60751 5	subjected to a compressive load of	Only
		resistance		500 N at 1550nm: ≤ 0.05dB.	omy
37		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
37		Tribuon ivinero bena	Ee 00751 1 31, Ee 00751 3	wrapped on a 60 mm diameter	Only
				mandrel for 100 turns at 1550 nm:	Omy
				$\begin{array}{c} \text{mander for foo turns at 1930 mm} : \\ \leq 0.05 \text{ dB} \end{array}$	
38		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3	_ 0.03 <b>u</b> D	Applicable for Ribbon Fibre
36		Ribbon Surpability Test	EC 00774-1-21, EC 00774-3		Only
39	Geometrical	Mode Field Diameter at	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics	1310 nm/1550nm	IEC 60793-2-50, 60793-1-45	TEC70012008 for respective type	of Optical fibre used in the
	of Fibre used in	1310 IIII/1330IIII	IEC 00793-2-30, 00793-1-43	of Optical fibre used in the cable	cable as per ITU-T G.65x
40	the cable	Cladding Diameter	ITU-T G.65x, G.650.1 and	or Optical Hore used in the cable	caute as per 11 U-1 U.UJX
40	uit Cavit	Clauding Diameter	IEC 60793-2-50, 60793-1-20,	Do	Do
41		Cladding Non-circularity	ITU-T G.65x, G.650.1 and		D0
41		Clauding Non-circularity		Do	Do
42		Core Clad concentricity	IEC 60793-2-50, 60793-1-20, ITU-T G.65x, G.650.1 and	Do	D0
42		1	IEC 60793-2-50, 60793-1-20,	Do	Do
43		error		D()	D0
43		Coating diameter	IEC 60793-2-50, 60793-1-21,	De	Do
4.4		C (C1 11)	FG (0702 2 50 (0702 1 21	Do	Do
44		Coating /Cladding	IEC 60793-2-50, 60793-1-21,		

		concentricity		Do	Do
45	Transmission	At 1550nm	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics of		IEC 60793-2-50, 60793-1-42,	TEC70012008 for respective type	of Optical fibre used in the
	Fibre used in the			of Optical fibre used in the cable	cable as per ITU-T G.65x
46	Cable (Chromatic	At 1625nm	ITU-T G.65x, G.650.1 and		
	Dispersion)		IEC 60793-2-50, 60793-1-42,	Do	Do
47		In 1285-1330nm band	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
48		In 1270-1340nm band	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
49		Zero Dispersion slope	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
50		Zero Dispersion	ITU-T G.65x, G.650.1 and		
		wavelength range	IEC 60793-2-50, 60793-1-42,	Do	Do
51	Transmission	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics	when fiber is coiled with	IEC 60793-2-50 and IEC	TEC70012008 for respective type	of Optical fibre used in the
	of Fibre used in	100 turns on $60 \pm 1.0$ mm	60793-1-47,	of Optical fibre used in the cable	cable as per ITU-T G.65x
	the cable	diameter mandrel			
52	(Fibre Macro	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,		
	bend loss)	when fiber is coiled with	IEC 60793-2-50 and IEC	Do	Do
		1 turn around $32 \pm 0.5$	60793-1-47,		
		mm diameter mandrel			
53		Change in attenuation	ITU-T G.652.D ,ITU-T	As per Annexure to TEC ER No:	Applicable to respective type
		when fiber is coiled with	G.650.1, IEC 60793-2-50 and	TEC70012008 for G.652.D type	of Optical fibre used in the
		100 turns on 50 $\pm$ 0.5 mm	IEC 60793-1-47,	of Optical fibre used in the cable	cable as per ITU-T G.652.D
		diameter mandrel	YEVY E. C. (250 1 YE)		
54		Change in attenuation	ITU-T G.657.A, G.650.1 IEC	As per Annexure to TEC ER No:	Applicable to respective type
		when fibre is coiled with	60793-2-50,	TEC70012008 for G.657.A1 &	of Optical fibre used in the
		10 turns on 15 mm radius	60793-1-47	G.657.A2 type of Optical fibre	cable as per ITU-T G.652.A
		mandrel	TELLE C. CET. A. O. C. CET. D.	used in the cable	A 1' 11 /
55		Change in attenuation	ITU-T G.657. A & G.657.B,	As per Annexure to TEC ER No:	Applicable to respective type
		when fibre is coiled with	G.650.1 and IEC 60793-2-50,	TEC70012008 for G.657.A1,	of Optical fibre used in the
		1 turn on 10 mm radius	60793-1-47,	G.657.A2 & G.657.B3 type of	cable as per ITU-T G.652.A
		mandrel		Optical fibre used in the cable	& G.657.B

56		Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel Change in attenuation when fibre is coiled with 1 turn on 5 mm radius	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47, ITU-T G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable  As per Annexure to TEC ER No: TEC70012008 for G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B  Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.B
58	Mechanical Characteristics of Fibre used in the cable	mandrel Peak Stripability force to remove primary coating of the fiber (Unaged, Water aged, Damp heat aged)	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
59		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
60	Colour qualification for color fibres	MEK RUB Test (Methyl Ethyl Ketone)	Draft IEC 60794-1-219,	Do	Do
61	Safety Requirement	The material used in the manufacturing of the OFC shall be non-toxic and dermatologically safe in its life time and shall not be hazardous to health.		The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of Optical fibre cable to substantiate the requirement.	

# Annexure-Tx-A3-OFC: Optical Fibre Cables for Aerial Applications (ADSS over Power line, ADSS on Aerial alignment, Lashed Aerial Cable and Optical Ground Wire-OPGW)

#### A3.1 Parameter Group: Optical Fibre Cable-ADSS along Power Line

SN	Parameter	Individual	Standard Name	Limits/Values	Applicability
	Name	Parameter Name			
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6 7		PMD Cabled Loose Fibre PMD Cabled	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48 ITU-T G.65x, G.650.1 and IEC	≤ 0.3 ps/√km	Do
8		Ribbon Fibre Cable Cut-off	60793-2-50, 60793-1-48 ITU-T G.65x, G.650.1 and IEC	1260nm Max.	
9	Mechanical Characteristics	Wavelength Tensile Strength	60793-2-50, 60793-1-44 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 6W/4W Newton (W-mass of 1 Km of cable in Kg)	Do 6W for ADSS cable for Hilly areas (with Ice loading) 4W for ADSS cable for Hilly areas (without Ice loading)

10	Crush Resistance	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 2200 N at 1550nm: ≤ 0.05dB	
11	Impact	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Impact of 20Nm	10 impacts shall be applied at the surface with the radius of 300mm.
12	Kink Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable)	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,	
14	Repeated Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsion Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable Drip Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.
17	Aeolian Vibration Test	IEC 60794-1-21 Method E19, IEC60794-4-20 IEEE1222,	Vibration cycles - 10 million.  The frequency of the test span shall be equal to and maintained at the nearest resonant frequency produced by a 16.1 km/hr wind (i.e., frequency = 82.92/diameter of cable in centimetres).	

			Change in attenuation at 1550nm: ≤	
			0.05dB after the test.	
18	Galloping Test	IEC 60794-1-21 Method E26,	Galloping cycles – 100000	
		IEC60794-4-20	The test frequency shall be the single-	
		IEEE 1222,	loop resonant frequency. The minimum	
			peak to-peak antinode amplitude/loop	
			length ratio shall be maintained at a	
			value of 1/25, as measured in the active	
			span. Change in attenuation at 1310 &	
			1550nm: $\leq$ 0.05dB after the test	
19	Creep Test	IEC 60794-4-20	A creep test shall be performed on an	
			ADSS sample approximately 10 m long.	
			The cable shall be terminated at each	
			end, and a tension of at least 50% of the	
			maximum rated cable loads shall be	
			applied and sustained for duration of at	
			least	
			1000 hrs. The elongation of the cable	
			versus time shall be measured at suitable	
			intervals and recorded.	
			Change in attenuation at 1310 &	
			1550nm: $\leq$ 0.05dB after the test	
20	Snatch Test	IEC 60794-1-2-E9	Sample Length: 4.5 m and firmly	
			clamped at the two ends so that sag of	
			300 mm, is formed. Testing load shall	
			be 300 N/500 N and the radius of	
			impacting surface of the crown of the	
			hook shall be 12.5 mm.	
			Change in attenuation at 1310 &	
			$1550$ nm: $\leq 0.05$ dB after the test	
21	Electrical Test/	IEC60794-4-20	Tracking on the outside of sheath shall	Applicable for ADSS cable
	Tracking &	IEEE Std 1222-2003	not result in erosion at any point of	with Anti-track PE Jacket
	Erosion Test	ASTM D 2309-97	sheath.	over high voltage power
				line

23	Environmental Characteristics	Abrasion Resistance Test Temperature Cycling	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,  IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.  Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C.	
				TB1 temperature: +60°C. TB2 temperature: +70°C. No. of temperature cycle: 2 Time at each temperature: 12hrs.	
24		Cable Aging test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
25		Water Blocking Test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
26		UV Radiation Test	IEC 60068-2-1, ASTM G-154- 12a, IEC 60794-1-22 Method F14,	Type of lamp: 40watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours There should not be any fading or change in colour of the sheath.	
27		Check of the effect of	ISO175, Annex R2	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the	

28		aggression media on the cable  Cable Material Compatibility	Telecordia GR 20, IEC 60794-3-	solutions and examined for any corrosion etc. on the sheath and other markings of the cables.  The sample should not show any effect of these solutions on the sheath and other marking of the cable  Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all RM are same in one
29	Characteristics	Kink resistance	IEC 60794-1-23, IEC 60794-3,	components within the cable structure  No damage or kink on surface of tube	of the cable design, then this test shall be skipped based on prior result. Applicable for all type of
	of Cable Elements (Buffer Tube)	Test	60794-3-11	when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Loose tube, Tight Buffer and Micromodule.
30	(201101 1000)	Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
31		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
32		Strippability Test  – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
33		Strippability Test Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two	Applicable for Micromodule only.

				fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	
34	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
35	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	- Breakout shall be accomplished without specialized tools or apparatus The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance; - Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.	Applicable for Ribbon Fibre Only
36		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
37		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
38		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
39		Ribbon Microbend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : $\leq$ 0.05 dB	Applicable for Ribbon Fibre Only
40		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3 Annex R1,		Applicable for Ribbon Fibre Only
41	Geometrical Characteristics	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used

	of Fibre used in				in the cable as per ITU-T
	the cable				G.65x
42		Cladding	ITU-T G.65x, G.650.1 and IEC		
		Diameter	60793-2-50, 60793-1-20,	Do	Do
43		Cladding Non-	ITU-T G.65x, G.650.1 and IEC		
		circularity	60793-2-50, 60793-1-20,	Do	Do
44		Core Clad	ITU-T G.65x, G.650.1 and IEC		
		concentricity	60793-2-50, 60793-1-20,	Do	Do
		error			
45		Coating	IEC 60793-2-50, 60793-1-21,		
		diameter		Do	Do
46		Coating	IEC 60793-2-50, 60793-1-21,		
		/Cladding		Do	Do
		concentricity			
47	Transmission	At 1550nm	ITU-T G.65x, G.650.1 and IEC	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics of		60793-2-50, 60793-1-42,	TEC70012008 for respective type of	type of Optical fibre used
	Fibre used in the			Optical fibre used in the cable	in the cable as per ITU-T
	Cable (Chromatic				G.65x
48	Dispersion)	At 1625nm	ITU-T G.65x, G.650.1 and IEC		
			60793-2-50, 60793-1-42,	Do	Do
49		In 1285-1330nm	ITU-T G.65x, G.650.1 and IEC		
		band	60793-2-50, 60793-1-42,	Do	Do
50		In 1270-1340nm	ITU-T G.65x, G.650.1 and IEC		
		band	60793-2-50, 60793-1-42,	Do	Do
51		Zero Dispersion	ITU-T G.65x, G.650.1 and IEC		
		slope	60793-2-50, 60793-1-42,	Do	Do
52		Zero Dispersion	ITU-T G.65x, G.650.1 and IEC		
		wavelength range	60793-2-50, 60793-1-42,	Do	Do
53	Transmission	Change in	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	attenuation when	IEC 60793-2-50 and IEC 60793-	TEC70012008 for respective type of	type of Optical fibre used
	of Fibre used in	fiber is coiled	1-47,	Optical fibre used in the cable	in the cable as per ITU-T
	the cable	with 100 turns on			G.65x
	(Fibre Macro	$60 \pm 1.0 \text{ mm}$			
	bend loss)	diameter mandrel			

54	Change in attenuation when fiber is coiled with 1 turn around 32 ± 0.5 mm diameter mandrel	ITU-T G.65x ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793- 1-47,	Do	Do
55	Change in attenuation when fiber is coiled with 100 turns on 50 ±0.5 mm diameter mandrel	ITU-T G.652.D ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793- 1-47,	As per Annexure to TEC ER No: TEC70012008 for G.652.D type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.D
56	Change in attenuation when fibre is coiled with 10 turns on 15 mm radius mandrel	ITU-T G.657.A, G.650.1 IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A1 & G.657.A2 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.A
57	Change in attenuation when fibre is coiled with 1 turn on 10 mm radius mandrel	ITU-T G.657. A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.A & G.657.B
58	Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.A & G.657.B

59		Change in	ITU-T G.657.B, G.650.1 and IEC	As per Annexure to TEC ER No:	Applicable to respective
39		_	60793-2-50,	TEC70012008 for G.657.B3 type of	type of Optical fibre used
		attenuation	60793-1-47	Optical fibre used in the cable	in the cable as per ITU-T
		when fibre is	00793-1-47	Optical fibre used in the cable	G.657.B
		coiled with 1			G.037.B
		turn on 5 mm			
		radius mandrel			
60	Mechanical	Peak Stripability	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	force to remove		TEC70012008 for respective type of	type of Optical fibre used
	of Fibre used in	primary coating		Optical fibre used in the cable	in the cable as per ITU-T
	the cable	of the fiber			G.65x
		(Unaged, Water			
		aged, Damp heat			
		aged)			
61		Fiber Curl	IEC 60793-2-50, 60793-1-34,		
				Do	Do
62	Colour	MEK RUB	Draft IEC 60794-1-219,		
	qualification for	Test (Methyl		Do	Do
	color fibres	Ethyl Ketone)			
63	Safety	The material used		The manufacturer shall submit MSDS	
	Requirement	in the		(Material safety Data Sheet) for all the	
		manufacturing of		material used in manufacturing of	
		the OFC shall be		Optical fibre cable to substantiate the	
		non-toxic and		requirement.	
		dermatologically			
		safe in its life			
		time and shall not			
		be hazardous to			
		health.			

## A3.2 Parameter Group: Optical Fibre Cable-ADSS on Aerial alignment

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 6W/4W/3W (or 4500N) Newton (Wmass of 1 Km of cable in Kg).	6W for Aerial cable for Hilly areas (with Ice loading) 4W for Aerial cable for Hilly areas (without Ice loading) 3W (or 4500N) for Aerial cable for Urban areas
10		Crush Resistance	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 2000 N.	

11	Impact	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Impact of 20Nm	10 impacts shall be applied at the surface with the radius of 300mm
12	Kink Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles	
14	Repeated Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsion Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable Drip Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.
17	Abrasion Resistance Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Steel needle diameter d = 1.0 mm load: 4 N No perforation & loss of legibility of the marking on the sheath.	
18	Aeolian Vibration Test	IEC 60794-1-21 Method E19, IEC60794-4-20	Vibration cycles - 10 million.	

		IEEE1000	The factor of the test area of all	
		IEEE1222,	The frequency of the test span shall	
			be equal to and maintained at the	
			nearest resonant frequency produced	
			by a 16.1 km/hr wind (i.e., frequency	
			= 82.92, diameter of cable in	
			centimetres).	
			Change in attenuation at 1550nm: ≤	
			0.05dB after the test.	
19	Galloping Test	IEC 60794-1-21 Method E26,	Galloping cycles – 100000	
		IEC60794-4-20	The test frequency shall be the	
		IEEE 1222,	single-loop resonant frequency. The	
		1222,	minimum peak to-peak antinode	
			amplitude/loop length ratio shall be	
			maintained at a value of 1/25, as	
			measured in the active span.	
			Change in attenuation at 1550nm: ≤	
			0.05dB after the test	
20	Creep Test	IEC60794-4-20,	A creep test shall be performed on an	
		,	ADSS sample approximately 10 m	
			long. The cable shall be terminated at	
			each end, and a tension of at least	
			50% of the maximum rated cable	
			loads shall be applied and sustained	
			for duration of at least 1000 hrs. The	
			elongation of the cable versus time	
			shall be measured at suitable	
			intervals and recorded.	
			Change in attenuation at 1310 &	
			1550nm: $\leq 0.05$ dB after the test	
21	Snatch Test	IEC 60794-1-2-E9	Sample Length: 4.5 m and firmly	
41	Shatch Test	ILC 00/94-1-2-L9	clamped at the two ends so that sag	
			of 300 mm, is formed. Testing load shall be 300 N and the radius of	
			impacting surface of the crown of the	
			hook shall be 12.5 mm.	

				Change in attenuation at 1310 & 1550nm: ≤ 0.05dB after the test	
22		Shotgun resistance Test	IEC 60794-1-2(E13 B) , IEC60794-4-20,	1330mm. \( \subseteq 0.03dB \) after the test	Applicable for ADSS cable on Aerial alignment, if required by user.
23	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle:  TA2 temperature: - 20°C  TA1 temperature: - 10°C.  TB1 temperature: + 60°C.  TB2 temperature: + 70°C.  No. of temperature cycle: 2  Time at each temperature: 12hrs.	required by aser.
24		Cable Aging test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
25		Water Blocking Test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
26		UV Radiation Test	IEC 60068-2-1, ASTM G-154-12a, IEC 60794-1-22 Method F14,	Type of lamp: 40watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours	

				There should not be any fading or	
			Y00155	change in colour of the sheath.	
27		Check of the	ISO175	The test samples are put in the PH4	
		effect of		and PH10 solutions separately. After	
		aggression media		30 days these samples are taken out	
		on the cable		from the solutions and examined for	
				any corrosion etc. on the sheath and	
				other markings of the cables.	
				The sample should not show any	
				effect of these solutions on the sheath	
				and other marking of the cable	
28		Cable Material	Telecordia GR 20, IEC 60794-3-11	Optical fibre, buffers/core tubes, and	Applicable as per IEC
-3		Compatibility		other core components shall meet the	60794-1-219 (draft) to
		Compationity		requirements of the compatibility	control the quality of
				with buffer/core tube filling	material and life span of the
				material(s) and/or water-blocking	cable.
				materials that are in direct contact	If all RM are same in one of
				with identified components within	the cable design, then this
				the cable structure	test shall be skipped based on
					prior result.
29	Characteristics	Kink resistance	IEC 60794-1-23, IEC 60794-3,	No damage or kink on surface of	Applicable for all type of
	of Cable	Test	60794-3-11	tube when tested 4 times with Kink	Loose tube, Tight Buffer and
	Elements			radius less than 15xD, D is the	Micromodule.
	(Buffer Tube)			diameter of the tube.	
30		Drainage	IEC 60794-1-21, IEC 60794-3,	No Flow shall be detected when	Applicable to jelly filled
		Test/Compound	60794-3-11	tested at a temperature of 70° C for	Loose tube and Micromodule
		Flow		a period of 24 Hrs.	Not applicable for Dry Tube.
31		Watertightness /	IEC 60794-1-22, IEC 60794-3	No water shall be detected at the	Applicable for all type of
		Water Blocking	60794-3-11	unsealed end of the sample. If a	Loose tube, Tight buffer and
		test		fluorescent dye is used, an ultraviolet	Micromodule.
				light may be used for the	
				examination.	
32		Strippability and	IEC 60794-3, IEC 60793-1-32,	3 mm length of outer sheath of tight	Applicable for Tight Buffer
32		access to the fiber	IEC 60793-1-32; IEC 60793-1-32;	buffer at a distance 30 mm from the	only.
			112 00793-1-32.2010	burier at a distance 30 mm from the	Omy.
		– Tight Buffer			

				end of the tight buffer, leaving the fibre undamaged	
33		Strippability and access to the fiber - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	Applicable for Micromodule only.
34	Characteristics	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
35	of Cable Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	<ul> <li>Breakout shall be accomplished without specialized tools or apparatus.</li> <li>The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;</li> <li>Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.</li> </ul>	Applicable for Ribbon Fibre Only
36		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
37		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only

38		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
39		Ribbon Microbend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : $\leq$ 0.05 dB	Applicable for Ribbon Fibre Only
40		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3 Annex R1,		Applicable for Ribbon Fibre Only
41	Geometrical Characteristics of Fibre used in	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
42	the cable	Cladding Diameter	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
43		Cladding Non- circularity	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
44		Core Clad concentricity error	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
45		Coating diameter	IEC 60793-2-50, 60793-1-21,	Do	Do
46		Coating /Cladding concentricity	IEC 60793-2-50, 60793-1-21,	Do	Do
47	Transmission Characteristics of Fibre used in	At 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
48	the Cable (Chromatic	At 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
49	Dispersion)	In 1285-1330nm band	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
50		In 1270-1340nm band	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
51		Zero Dispersion slope	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
52		Zero Dispersion wavelength range	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do

53	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	Change in attenuation when fiber is coiled with 100 turns on 60 ±1.0 mm diameter mandrel	ITU-T G.65x ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
54		Change in attenuation when fiber is coiled with 1 turn around 32 ± 0.5 mm diameter mandrel	ITU-T G.65x ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793-1-47,	Do	Do
55		Change in attenuation when fiber is coiled with 100 turns on 50 ±0.5 mm diameter mandrel	ITU-T G.652.D ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793-1- 47,	As per Annexure to TEC ER No: TEC70012008 for G.652.D type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.D
56		Change in attenuation when fibre is coiled with 10 turns on 15 mm radius mandrel	ITU-T G.657.A, G.650.1 IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A1 & G.657.A2 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A
57		Change in attenuation when fibre is coiled with 1 turn on 10 mm radius mandrel	ITU-T G.657. A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
58		Change in attenuation when fibre is	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B

		coiled with 1			
		turn on 7.5 mm			
		radius mandrel			
59		Change in	ITU-T G.657.B, G.650.1 and IEC	As per Annexure to TEC ER No:	Applicable to respective type
		attenuation	60793-2-50,	TEC70012008 for G.657.B3 type of	of Optical fibre used in the
		when fibre is	60793-1-47	Optical fibre used in the cable	cable as per ITU-T G.657.B
		coiled with 1			
		turn on 5 mm			
		radius mandrel			
60	Mechanical	Peak Stripability	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics	force to remove		TEC70012008 for respective type of	of Optical fibre used in the
	of Fibre used in	primary coating of		Optical fibre used in the cable	cable as per ITU-T G.65x
	the cable	the fiber (Unaged,			
		Water aged, Damp			
		heat aged)			
61		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
62	Colour	MEK RUB	Draft IEC 60794-1-219,	Do	Do
	qualification for	Test (Methyl			
	color fibres	Ethyl Ketone)			
63	Safety	The material used		The manufacturer shall submit	
	Requirement	in the		MSDS (Material safety Data Sheet)	
	_	manufacturing of		for all the material used in	
		the OFC shall be		manufacturing of Optical fibre cable	
		non-toxic and		to substantiate the requirement.	
		dermatologically		_	
		safe in its life time			
		and shall not be			
		hazardous to			
		health.			

### **A3.3** Parameter Group: Optical Fibre Cable- Lashed Aerial Cable

SN	Parameter Name	Individual Parameter	Standard Name	Limits/Values	Applicability
	Name	Name			
1	Transmission	Attenuation at	ITU-T G.65x, G.650.1 and IEC	≤ 0.36 dB/Km	Applicable to respective
	Characteristics	1310nm	60793-2-50, 60793-1-40,		type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at	ITU-T G.65x, G.650.1 and IEC	≤ attenuation at 1310 nm	
		1383nm	60793-2-50, 60793-1-40,		Do
3		Attenuation at	ITU-T G.65x, G.650.1 and IEC	≤ 0.26 dB/Km	
		1490 nm	60793-2-50, 60793-1-40,		Do
4		Attenuation at	ITU-T G.65x, G.650.1 and IEC	≤ 0.22 dB/Km	
		1550nm	60793-2-50, 60793-1-40,		Do
5		Attenuation at	ITU-T G.65x, G.650.1 and IEC	≤ 0.25 dB/Km	_
		1625nm	60793-2-50, 60793-1-40,		Do
6		PMD Cabled	ITU-T G.65x, G.650.1 and IEC		
		Loose Fibre	60793-2-50, 60793-1-48	<u> </u>	
7		PMD Cabled	ITU-T G.65x, G.650.1 and IEC	100	-
		Ribbon Fibre	60793-2-50, 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
8		Cable Cut-off	ITU-T G.65x, G.650.1 and IEC		
		Wavelength	60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical	Tensile Strength	IEC 60794-1-21, 60794-3,	Change in attenuation at 1550 nm: ≤	
	Characteristics		60794-3-10, 60794-3-11,	$0.05$ dB & Fiber strain $\leq 0.25\%$ when	
				subjected to a Tensile load of 1.3 W or 500 N whichever is more	
10		Crush	IEC 60794-1-21, 60794-3,	Change in attenuation at 1550nm: ≤	
		Resistance	60794-3-10, 60794-3-11,	0.05dB.when subjected to a compressive	
			, , , , , , , , , , , , , , , , , , ,	load of 1000 N	

11		Impact	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB.when subjected to Impact of	
12		Kink Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	12.5Nm  Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	_	Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14		Repeated Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15		Torsion Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16		Cable Drip Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.
17		Abrasion Resistance Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.	
18	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C	

10		4 FG 60704 1 22 60704 2	TA1 temperature: - 10°C. TB1 temperature: + 60°C. TB2 temperature: + 70°C. No. of temperature cycle: 2 Time at each temperature: 12hrs.	
19	Cable Aging te	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: $\leq$ 0.05dB, when cable is exposed to 85 °C $\pm$ 2 °C for a minimum of 168 hours.	
20	Water Blocking Test	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
21	UV Radiation Test	IEC 60068-2-1, ASTM G-154- 12a, IEC 60794-1-22 Method F14,	Type of lamp: 40watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours There should not be any fading or change in colour of the sheath.	
22	Check of the effect of aggression media on the cable	ISO175	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables.  The sample should not show any effect of these solutions on the sheath and other marking of the cable	

23		Cable Material Compatibility	Telecordia GR 20, IEC60794	Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all RM are same in one of the cable design, then this test shall be skipped based on prior result.
24	Characteristics of Cable Elements	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
25	(Buffer Tube)	Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
26		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
27		Strippability and access to the fiber – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 50 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
28		Strippability and access to the fiber - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	Applicable for Micromodule only.

29	Characteristics	Ribbon	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre	Applicable for Ribbon
	of Cable	Dimension		count Ribbon	Fibre Only
30	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	<ul><li>Breakout shall be accomplished without specialized tools or apparatus.</li><li>The fibre breakout procedure shall not be permanently detrimental to the fibre</li></ul>	Applicable for Ribbon Fibre Only
				optical and mechanical performance; - Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.	
31		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
32		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
33		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
34		Ribbon Microbend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : ≤ 0.05 dB	Applicable for Ribbon Fibre Only
35		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3 Annex R1,		Applicable for Ribbon Fibre Only
36	Geometrical Characteristics of Fibre used in the cable	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
37		Cladding Diameter	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
38		Cladding Non- circularity	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
39		Core Clad concentricity error	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do

40		Coating	IEC 60793-2-50, 60793-1-21,		
		diameter		Do	Do
41		Coating	IEC 60793-2-50, 60793-1-21,		
		/Cladding		Do	Do
		concentricity			
42	Transmission	At 1550nm	ITU-T G.65x, G.650.1 and IEC	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics		60793-2-50, 60793-1-42,	TEC70012008 for respective type of	type of Optical fibre used in
	of Fibre used in			Optical fibre used in the cable	the cable as per ITU-T
10	the Cable	1.1605	INVESTIGATION OF THE CONTRACT		G.65x
43	(Chromatic	At 1625nm	ITU-T G.65x, G.650.1 and IEC	D.	<b>D</b>
4.4	Dispersion)	I 1205 1220	60793-2-50, 60793-1-42,	Do	Do
44		In 1285-1330nm	ITU-T G.65x, G.650.1 and IEC	D.	D.
45		band In 1270-1340nm	60793-2-50, 60793-1-42, ITU-T G.65x, G.650.1 and IEC	Do	Do
45		band	60793-2-50, 60793-1-42,	Do	Do
46		Zero Dispersion	ITU-T G.65x, G.650.1 and IEC		D0
40		slope	60793-2-50, 60793-1-42,	Do	Do
47		Zero Dispersion	ITU-T G.65x, G.650.1 and IEC		D0
7 /		wavelength	60793-2-50, 60793-1-42,	Do	Do
		range	00773-2-30, 00773-1-42,		
48	Transmission	Change in	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	attenuation when	IEC 60793-2-50 and IEC 60793-	TEC70012008 for respective type of	type of Optical fibre used in
	of Fibre used in	fiber is coiled	1-47, Annex R1	Optical fibre used in the cable	the cable as per ITU-T
	the cable	with 100 turns		•	G.65x
	(Fibre Macro	on 60 ±1.0 mm			
	bend loss)	diameter			
		mandrel			
49		Change in	ITU-T G.65x ,ITU-T G.650.1,		
		attenuation when	IEC 60793-2-50 and IEC 60793-	Do	Do
		fiber is coiled	1-47, Annex R1		
		with 1 turn			
		around $32 \pm 0.5$			
		mm diameter			
		mandrel			

50	Change in attenuation when fiber is coiled with 100 turns on 50 ±0.5 mm diameter mandrel	ITU-T G.652.D ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793- 1-47, Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.652.D type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.D
51	Change in attenuation when fibre is coiled with 10 turns on 15 mm radius mandrel	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-47 Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.657.A1 & G.657.A2 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A
52	Change in attenuation when fibre is coiled with 1 turn on 10 mm radius mandrel	ITU-T G.657. A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47, Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
53	Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47, Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
54	Change in attenuation when fibre is coiled with 1 turn on 5 mm radius mandrel	ITU-T G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47 Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.B

55	Mechanical Characteristics of Fibre used in the cable	Peak Stripability force to remove primary coating of the fiber (Unaged, Water aged, Damp heat aged)	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
56		Fiber Curl	IEC 60793-2-50, 60793-1-34,		
			,	Do	Do
57	Colour	MEK RUB	Draft IEC 60794-1-219,		
	qualification for	Test (Methyl		Do	Do
	color fibres	Ethyl Ketone)			
58	Safety	The material		The manufacturer shall submit MSDS	
	Requirement	used in the		(Material safety Data Sheet) for all the	
		manufacturing		material used in manufacturing of Optical	
		of the OFC shall		fibre cable to substantiate the requirement.	
		be non-toxic and			
		dermatologically			
		safe in its life			
		time and shall			
		not be hazardous			
		to health.			

## **A3.4** Parameter Group: Optical Ground Wire - OPGW

SN	Parameter	Individual	Standard Name	Limits/Values	Applicability
	Name	Parameter Name			
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		_
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength (Ultimate)	IEEE 1138: 2009 Annexure –	The ultimate tensile strength of the OPGW cable shall meet or exceed 100% of the RTS of the cable. Any outer layer strand failing below 75 % of the cable RTS shall constitute cable failure. Optical performance of OPGW cable shall be monitored during this test. A permanent increase in Optical Attenuation shall not be greater than 0.05 dB at 1550nm wavelength	

10	Creep Test	IEEE 1138: 2009 Annexure –	A permanent increase in Optical Attenuation shall not be greater than 0.05 dB at 1550nm wavelength	
11	Stress Strain Test	IEEE 1138: 2009 Annexure –	The breaking strength of the OPGW cable shall meet or exceed 100% of the RTS of the cable. Optical performance of OPGW cable shall be monitored during the test. A permanent increase in Optical Attenuation shall not be greater than 0.05 dB at 1550nm wavelength	
12	Strain Margin Test	IEEE 1138: 2009 Annexure –	The cable shall show no permanent increase in optical attenuation greater than 0.05 dB from preload to the maximum rated design tension (MRDT) of the cable at 1550nm wavelength	
13	Sheave Test	IEEE 1138 : 2009/IEC-60794- 1-2-E9	The Ovality of the cable or optical units at the measured locations shall not exceed 10 %. Cracking or breaking of any component of the OPGW cable shall be visually examined. A permanent increase in Optical Attenuation shall not be greater than 0.05 dB at 1550nm wavelength	
14	Crush Test	IEEE 1138 : 2009/ IEC 60794- 1-2-E3	Change in attenuation when subjected to a compressive load of 0.4 W N at 1550nm: ≤ 0.05dB. Ovality of the cable or optical fiber units shall be < 10 %.	
15	Bend Test	IEEE 1138 : 2009/IEC 60794- 1-2-E11 (Procedure-I)	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles and there shall be no damage to the sheath or to the cable elements under visual examination without magnification	
16	Torsion Test	IEC 60794-1-2-E7	The length of the specimen under test shall be 10 meters and the load shall be 100 N (20% of the cable RTS).	

17		Impact Test	IEC 60794-1-2-E4	The cable shall be examined physically for any cracking and breaking of OPGW cable. The twist mark shall not be taken as damage. The change in attenuation of the fibre after the test shall be < 0.05 dB at 1550 nm wavelength  Change in attenuation at 1550nm: ≤ 0.05dB.when subjected to Impact of 30	
18		Repeated Bending	IEC 60794-1-2-E6	Nm  Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
19		Aeolian Vibration Test	IEEE 1138 : 2009, IEC 60794- 1-2-E19	Vibration cycles − 10 million Change in attenuation at 1550nm: ≤ 0.05dB after the test	
20		Galloping Test	IEEE 1138 : 2009	Galloping cycles − 100000 Change in attenuation at 1550nm: ≤ 0.05dB after the test	
21		Drip Test	IEEE 1138: 2009/ TIA/EIA- 455-81-B	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	
22	Electrical Characteristics	DC Resistance	IEEE 1138: 2009 Annexure –	The actual dc resistance of the OPGW cable shall not exceed the dc resistance stated by the manufacturer at the specified temperature.	
23		Short Circuit Test	IEEE 1138 : 2009/IEC 60794- 1-2-H1	Any cracking or breaking of any component of the optical sample shall constitute failure. This assessment is made with the naked eye.	

24		Lightning Arc	IEEE 1138 : 2009	There shall be no permanent increase in	
		Test		optical attenuation greater than 0.05 dB at	
				1550nm wavelengths.	
				The minimum remaining strength of any	
				of the tested cable sections shall be	
				greater than the cable RTS	
25		Electrical		The metallic elements shall be continuous.	
		Continuity Test			
26	Environmental	Water Penetration	IEEE 1138 : 2009/IEC 60794-	Test duration: 168 hour	Test shall be conducted on
	Characteristics	Test	1-2-F5B	Sample length: 3 m	the Optical Core Only.
				Water Head Height: 1m	Other Components shall be
				No dye shall be detected when the end of	removed before the start of
				the 3m length is examined with ultraviolet	the test.
				light detector. The cable sample under test	No water shall be detected
				for 7 days, shall be ripped open after the	at the unsealed end of the
				test and then it shall be examined for	sample. If a fluorescent dye
				seepage of water into the cable and it shall	is used, an ultraviolet light
				not be more than 20 cm.	may be used for the
					examination.
27		Temperature	IEEE 1138 : 2009 (6.4.3.7) /	Change in attenuation at 1550nm: ≤	
		Cycle Test	IEC-60794-1-2-F1	0.05dB when subjected to following	
				temperature cycle:	
				TA2 temperature: - 20°C	
				TA1 temperature: - 10°C.	
				TB1 temperature: + 60°C.	
				TB2 temperature: + 70°C.	
				No. of temperature cycle: 2	
				Time at each temperature : 12hrs.	
28		Salt Spray	IEEE 1138 : 2009	At the end of the test, the cables are to be	
		Corrosion Test		removed and dissected for corrosion	
				damage. The cables have passed the test	
				if:	
				a) There are no locations where the	
				aluminum-clad steel wires have been	

29		Cable Material Compatibility	Telecordia GR 20, IEC 60794-3-11	strength member in any way what so ever. b) There are no locations where solid aluminum wires have been point pitted beyond a depth of 10% of the total individual wires diameter at the point of the pit. c) There is no damage to the internal fiber containment tubing. d) In the case of aluminum coated tubing, there can be no removal of the aluminum coating that exposes the underlying stainless steel tube. e) In the case of "other" coated tubing, there can be no removal of the coating that exposes the underlying tubing to the elements.  Optical fibre, buffers/core tubes, and other core components shall meet the	Applicable as per IEC 60794-1-219 (draft) to
				requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	control the quality of material and life span of the cable.  If all RM are same in one of the cable design, then this test shall be skipped based on prior result.
30	Characteristics of Cable Elements	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
31	(Buffer Tube)	Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.

32		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
33		Strippability and access to the fiber – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010, Annex R2	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
34		Strippability and access to the fiber - Micromodule	Annex R2	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	Applicable for Micromodule only.
35	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3, Annex R2	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
36	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3, Annex R2	<ul> <li>Breakout shall be accomplished without specialized tools or apparatus.</li> <li>The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;</li> <li>Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.</li> </ul>	Applicable for Ribbon Fibre Only
37		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3 Annex R2	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
38		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3 Annex R2	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only

39		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3 Annex R2	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
40		Ribbon Microbend	IEC 60794-1-31, IEC 60794-3 Annex R2	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : $\leq$ 0.05 dB	Applicable for Ribbon Fibre Only
41		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3 Annex R1,		Applicable for Ribbon Fibre Only
42	Geometrical Characteristics of Fibre used in the cable	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
43		Cladding Diameter	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
44		Cladding Non- circularity	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
45		Core Clad concentricity error	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
46		Coating diameter	IEC 60793-2-50, 60793-1-21,	Do	Do
47		Coating /Cladding concentricity	IEC 60793-2-50, 60793-1-21,	Do	Do
48	Transmission Characteristics of Fibre used in the Cable	At 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
49	(Chromatic Dispersion)	At 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
50		In 1285-1330nm band	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
51		In 1270-1340nm band	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do

52		Zero Dispersion	ITU-T G.65x, G.650.1 and		
		slope	IEC 60793-2-50, 60793-1-42,	Do	Do
53		Zero Dispersion	ITU-T G.65x, G.650.1 and		
		wavelength range	IEC 60793-2-50, 60793-1-42,	Do	Do
54	Transmission	Change in	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	attenuation when	IEC 60793-2-50 and IEC	TEC70012008 for respective type of	type of Optical fibre used in
	of Fibre used in	fiber is coiled with	60793-1-47,	Optical fibre used in the cable	the cable as per ITU-T
	the cable	100 turns on 60			G.65x
	(Fibre Macro	±1.0 mm diameter			
	bend loss)	mandrel			
55		Change in	ITU-T G.65x ,ITU-T G.650.1,		
		attenuation when	IEC 60793-2-50 and IEC	Do	Do
		fiber is coiled with	60793-1-47,		
		1 turn around 32 $\pm$			
		0.5 mm diameter			
		mandrel			
56		Change in	ITU-T G.652.D ,ITU-T	As per Annexure to TEC ER No:	Applicable to respective
		attenuation when	G.650.1, IEC 60793-2-50 and	TEC70012008 for G.652.D type of	type of Optical fibre used in
		fiber is coiled with	IEC 60793-1-47,	Optical fibre used in the cable	the cable as per ITU-T
		100 turns on 50			G.652.D
		±0.5 mm diameter			
		mandrel	TEXT TO COME A CONTROL OF CONTROL	A A TELEGIED M	
57		Change in	ITU-T G.657.A, G.650.1 IEC	As per Annexure to TEC ER No:	Applicable to respective
		attenuation when	60793-2-50,	TEC70012008 for G.657.A1 & G.657.A2	type of Optical fibre used in
		fibre is coiled with 10 turns on 15 mm	60793-1-47	type of Optical fibre used in the cable	the cable as per ITU-T
					G.652.A
58		radius mandrel	ITU-T G.657. A & G.657.B,	As you Agreements TECED No.	A multipalata ta magna atima
38		Change in attenuation when	G.650.1 and IEC 60793-2-50,	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 &	Applicable to respective
		fibre is coiled with	60793-1-47,		type of Optical fibre used in the cable as per ITU-T
		1 turn on 10 mm	00/93-1-4/,	G.657.B3 type of Optical fibre used in the cable	G.652.A & G.657.B
		radius mandrel		Cable	G.032.A & G.037.B
59		Change in	ITU-T G.657.A & G.657.B,	As per Annexure to TEC ER No:	Applicable to respective
39		attenuation when	G.650.1 and IEC 60793-2-50,	TEC70012008 for G.657.A2 & G.657.B3	type of Optical fibre used in
		fibre is coiled with	60793-1-47,	type of Optical fibre used in the cable	type of Optical fibre used in
		note is coned with	UU/73-1-4/,	type of Optical fibre used in the cable	

	I	14. 55		T	.1 1.1 YEVY Y. CC
		1 turn on 7.5 mm			the cable as per ITU-T
		radius mandrel			G.652.A & G.657.B
60		Change in	ITU-T G.657.B, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective
		attenuation	IEC 60793-2-50,	TEC70012008 for G.657.B3 type of	type of Optical fibre used in
		when fibre is	60793-1-47	Optical fibre used in the cable	the cable as per ITU-T
		coiled with 1			G.657.B
		turn on 5 mm			
		radius mandrel			
61	Mechanical	Peak Stripability	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	force to remove		TEC70012008 for respective type of	type of Optical fibre used in
	of Fibre used in	primary coating of		Optical fibre used in the cable	the cable as per ITU-T
	the cable	the fiber (Unaged,			G.65x
		Water aged, Damp			
		heat aged)			
62		Fiber Curl	IEC 60793-2-50, 60793-1-34,		
				Do	Do
63	Colour	MEK RUB	Draft IEC 60794-1-219,		
	qualification for	Test (Methyl		Do	Do
	color fibres	Ethyl Ketone)			
64	Safety	The material used		The manufacturer shall submit MSDS	
	Requirement	in the		(Material safety Data Sheet) for all the	
		manufacturing of		material used in manufacturing of Optical	
		the OFC shall be		fibre cable to substantiate the requirement.	
		non-toxic and		•	
		dermatologically			
		safe in its life time			
		and shall not be			
		hazardous to			
		health.			
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# Annexure-Tx-A4-OFC: Optical Fibre Cables for Access Network Applications (Indoor Cable, Outdoor Cable, Riser Cable, Indoor/Outdoor Cable, In-Home Cable)

#### **A4.1 Parameter Group: Optical Fibre Cable –Indoor**

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km (A1) ≤ 0.37 dB/Km (A2) ≤ 0.37 dB/Km (B3)	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1383nm	Do	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	Do	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	Do	≤ 0.22 dB/Km (A1) ≤ 0.23 dB/Km (A2) ≤ 0.24 dB/Km (B3)	Do
5		Attenuation at 1625nm	Do	≤ 0.25 dB/Km (A) ≤ 0.26 dB/Km (B3)	Do
6		PMD Cabled Loose Fibre	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	Do	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
8		Cable Cut-off Wavelength	ITU-T G. 657, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do

9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 660 N/1.5 W	660 Newton for Flexible Cable 1.5 W for Non-Flexible Cable.
10		Crush Resistance	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 500 N	
11		Impact	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Impact of 1 J	
12		Kink Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13		Bend Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14		Repeated Bend Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15		Torsion Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16		Cable Drip Test	IEC 60794-1-21, 60794-2,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.
17		Abrasion Resistance Test	IEC 60794-1-21, 60794-2,	Steel needle diameter d = 1.0 mm, load: 4 N	

	]			No perforation & loss of legibility of	
				the marking on the sheath.	
18	Environmental	Temperature Cycling	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
	Characteristics		60794-2,	0.05dB when subjected to following	
				temperature cycle:	
				TA2 temperature: - 20°C	
				TA1 temperature: - 10°C.	
				TB1 temperature: + 60°C.	
				TB2 temperature: + 70°C.	
				No. of temperature cycle: 2	
				Time at each temperature : 12hrs.	
19		Cable Aging test	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
			60794-2,	0.05dB, when cable is exposed to 85	
				$^{\circ}$ C $\pm$ 2 $^{\circ}$ C for a minimum of 168	
				hours.	
20		Water Blocking Test	IEC 60794-1-22,	Test duration: 168 hour	No water shall be detected at the
			60794-2,	Sample length: 3 m	unsealed end of the sample. If a
				Water Head Height: 1m	fluorescent dye is used, an
				No dye shall be detected when the	ultraviolet light may be used for
				end of the 3m length is examined	the examination.
				with ultraviolet light detector. The	
				cable sample under test for 7 days,	
				shall be ripped open after the test and	
				then it shall be examined for seepage	
				of water into the cable and it shall not	
21	<u> </u>	Check of the effect of	ICO175	be more than 20 cm.	
21			ISO175	The test samples are put in the PH4	
		aggression media on the cable		and PH10 solutions separately. After	
		cable		30 days these samples are taken out from the solutions and examined for	
				any corrosion etc. on the sheath and	
				other markings of the cables.	
				The sample should not show any	
				effect of these solutions on the sheath	
				and other marking of the cable	
				and other marking of the cable	

22		Cable Material	Telecordia GR 20,	Optical fibre, buffers/core tubes, and	Applicable as per IEC 60794-1-
		Compatibility	IEC60794	other core components shall meet the	219 (draft) to control the quality
				requirements of the compatibility	of material and life span of the
				with buffer/core tube filling	cable.
				material(s) and/or water-blocking	If all RM are same in one of the
				materials that are in direct contact	cable design, then this test shall
				with identified components within the	be skipped based on prior result.
				cable structure	
23	Characteristics	Kink resistance Test	IEC 60794-1-23, IEC	No damage or kink on surface of tube	Applicable for all type of Loose
	of Cable		60794-3, 60794-3-11	when tested 4 times with Kink radius	tube, Tight Buffer and
	Elements			less than 15xD, D is the diameter of	Micromodule.
	(Buffer Tube)			the tube.	
24		Drainage Test/Compound	IEC 60794-1-21, IEC	No Flow shall be detected when	Applicable to jelly filled Loose
		Flow	60794-3, 60794-3-11	tested at a temperature of 70° C for a	tube and Micromodule
2.5		***	TEG (0504 1 22 TEG	period of 24 Hrs.	Not applicable for Dry Tube.
25		Watertightness /	IEC 60794-1-22, IEC	No water shall be detected at the	Applicable for all type of Loose
		Water Blocking test	60794-3 60794-3-11	unsealed end of the sample. If a	tube, Tight buffer and
				fluorescent dye is used, an ultraviolet	Micromodule.
				light may be used for the examination.	
26		Strippability and access to	IEC 60794-3, IEC	3 mm length of outer sheath of tight	Applicable for Tight Buffer
20		the fiber – Tight Buffer	60793-1-32,	buffer at a distance 30 mm from the	only.
		the fiber – Fight Buffer	IEC 60793-1-32:2010	end of the tight buffer, leaving the	Ollry.
			ILC 00773-1-32.2010	fibre undamaged	
				Tible undamaged	
27		Strippability and access to	-	It must be possible to remove the	Applicable for Micromodule
		the fiber - Micromodule		sheath manually by squeezing it	only.
				between two fingers without pinching	
				it with your finger nails, and pulling	
				on each side of the required break	
				point. Once the sheath has been	
				broken, it must slide easily over at	
				least 10 cm to expose the end fibres.	
				The fibres must retain their	

				mechanical strength after this	
				operation.	
28	Characteristics	Ribbon Dimension	IEC 60794-1-23, IEC	As per IEC standard of different fibre	Applicable for Ribbon Fibre
	of Cable		60794-3	count Ribbon	Only
29	Elements	Separability of individual	IEC 60794-1-23, IEC	- Breakout shall be accomplished	Applicable for Ribbon Fibre
	(Ribboned	fibres from ribbon	60794-3	without specialized tools or	Only
	Fibre)			apparatus.	
				- The fibre breakout procedure shall	
				not be permanently detrimental to	
				the fibre optical and mechanical	
				performance;	
				- Any colour coding of fibres shall	
				remain sufficiently intact to enable	
				individual fibres to be distinguished from each other.	
30		Ribbon Compression	IEC 60794-1-31, IEC	Change in attenuation when subjected	Applicable for Ribbon Fibre
30		Resistance	60794-3	to a compressive load of 500 N at	Only
		Resistance	00774-3	1550nm: ≤ 0.05dB.	Only
31		Ribbon Twist Test	IEC 60794-1-31, IEC	Change in attenuation when subjected	Applicable for Ribbon Fibre
		Tuesdir I wist Test	60794-3	to a compressive load of 500 N at	Only
				1550nm: ≤ 0.05dB.	
32		Ribbon Torsion	IEC 60794-1-31, IEC	Change in attenuation when subjected	Applicable for Ribbon Fibre
		Resistance	60794-3	to a compressive load of 500 N at	Only
				$1550$ nm: $\leq 0.05$ dB.	
33		Ribbon Micro-bend	IEC 60794-1-31, IEC	Change in attenuation when wrapped	Applicable for Ribbon Fibre
			60794-3	on a 60 mm diameter mandrel for 100	Only
				turns at 1550 nm : ≤ 0.05 dB	
34		Ribbon Stripability Test	IEC 60794-1-21, IEC		Applicable for Ribbon Fibre
			60794-3		Only
35	Geometrical	Mode Field Diameter at	ITU-T G.657, G.650.1	As per Annexure to TEC ER No:	Applicable to respective type of
	Characteristics	1310 nm/1550nm	and IEC 60793-2-50,	TEC70012008 for respective type of	Optical fibre used in the cable
26	of Fibre used in	Cl 11. D.	60793-1-45	Optical fibre used in the cable	as per ITU-T G.657
36	the cable	Cladding Diameter	ITU-T G.657, G.650.1	D.	D-
			and IEC 60793-2-50,	Do	Do
			60793-1-20,		

37		Cladding Non-circularity			
			Do	Do	Do
38		Core Clad concentricity			
		error	Do	Do	Do
39		Coating diameter	IEC 60793-2-50,		
		-	60793-1-21,	Do	Do
40		Coating /Cladding	IEC 60793-2-50,		
		concentricity	60793-1-21,	Do	Do
41	Transmission	At 1550nm	ITU-T G.657, G.650.1	As per Annexure to TEC ER No:	Applicable to respective type of
	Characteristics		and IEC 60793-2-50,	TEC70012008 for respective type of	Optical fibre used in the cable
	of Fibre used in		60793-1-42,	Optical fibre used in the cable	as per ITU-T G.65x
42	the Cable	At 1625nm	ITU-T G.657, G.650.1		
	(Chromatic		and IEC 60793-2-50,	Do	Do
	Dispersion)		60793-1-42,		
43		In 1285-1330nm band	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
44		In 1270-1340nm band	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
45		Zero Dispersion slope	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
46		Zero Dispersion	ITU-T G.657, G.650.1		
		wavelength range	and IEC 60793-2-50,	Do	Do
			60793-1-42,		
47	Transmission	Change in attenuation	ITU-T G.657.A,	As per Annexure to TEC ER No:	Applicable to respective type of
	Characteristics	when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.A1 &	Optical fibre used in the cable
	of Fibre used in	10 turns on 15 mm radius	60793-2-50, 60793-1-	G.657.A2 type of Optical fibre used	as per ITU-T G.652.A
	the cable	mandrel	47	in the cable	
48	(Fibre Macro	Change in attenuation	ITU-T G.657. A,	As per Annexure to TEC ER No:	Applicable to respective type of
	bend loss)	when fibre is coiled with 1	G.650.1 and IEC	TEC70012008 for G.657.A1,	Optical fibre used in the cable
		turn on 10 mm radius	60793-2-50, 60793-1-	G.657.A2 & G.657.B3 type of	as per ITU-T G.652.A &
		mandrel	47	Optical fibre used in the cable	G.657.B

		Г <i>а</i>		T	
49		Change in attenuation	ITU-T G.657.A &	As per Annexure to TEC ER No:	Applicable to respective type of
		when fibre is coiled with 1	G.657.B, G.650.1 and	TEC70012008 for G.657.A2 &	Optical fibre used in the cable
		turn on 7.5 mm radius	IEC 60793-2-50,	G.657.B3 type of Optical fibre used	as per ITU-T G.652.A &
		mandrel	60793-1-47, Annex R1	in the cable	G.657.B
50		Change in attenuation	ITU-T G.657.B,	As per Annexure to TEC ER No:	Applicable to respective type of
		when fibre is coiled with 1	G.650.1 and IEC	TEC70012008 for G.657.B3 type of	Optical fibre used in the cable
		turn on 5 mm radius	60793-2-50, 60793-1-	Optical fibre used in the cable	as per ITU-T G.657.B
		mandrel	47, Annex R1		_
51	Mechanical	Peak Stripability force to	IEC 60793-2-50,	As per Annexure to TEC ER No:	Applicable to respective type of
	Characteristics	remove primary coating of	60793-1-32,	TEC70012008 for respective type of	Optical fibre used in the cable
	of Fibre used in	the fiber (Unaged, Water		Optical fibre used in the cable	as per ITU-T G.65x
	the cable	aged, Damp heat aged)			•
52		Fiber Curl	IEC 60793-2-50,		
			60793-1-34,	Do	Do
53	Colour	MEK RUB Test	Draft IEC 60794-1-		
	qualification for	(Methyl Ethyl Ketone)	219,	Do	Do
	color fibres				
54	Safety	Flame Spread-Single cable	IEC/EN 60332-1-2	Char less than 0.54 m at completion	
	Requirement	,		of test	
55	_	Flame Spread- Bunched	IEC/EN 60332-3-24:	Char less than 2.5 m at completion of	
		cable	2018, Cat C	the test	
56		Smoke Test	IEC/EN 61034-2	Minimum transmittance 60%	
57		Acid gas (Toxicity) (Test	IEC/EN 60754-2	pH not less than 4.3	
		on toxic gases evolved		Conductivity not more than 10	
		during combustion of		μS/mm	
		materials from cables)		·	
58		The material used in the		The manufacturer shall submit MSDS	
		manufacturing of the OFC		(Material safety Data Sheet) for all the	
		shall be non-toxic and		material used in manufacturing of	
		dermatologically safe in		Optical fibre cable to substantiate the	
		its life time and shall not		statement.	
		be hazardous to health.			
			l	L	

## **A4.2** Parameter Group: Optical Fibre Cable –Outdoor

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km (A1) ≤ 0.37 dB/Km (A2) ≤ 0.37 dB/Km (B3)	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1383nm	Do	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	Do	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	Do	≤ 0.22 dB/Km (A1) ≤ 0.23 dB/Km (A2) ≤ 0.24 dB/Km (B3)	Do
5		Attenuation at 1625nm	Do	≤ 0.25 dB/Km (A) ≤ 0.26 dB/Km (B3)	Do
6		PMD Cabled Loose Fibre	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	Do	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
8		Cable Cut-off Wavelength	ITU-T G. 657, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 2 W or 1000 Newton Whichever is higher.	

10	Crush Resistance	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 1000N.	
11	Impact	IEC 60794-1-21, 60794-2,	Change in attenuation when subjected to Impact of 12.5 Nm at 1550nm: ≤ 0.05dB.	
12	Kink Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14	Repeated Bend Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsion Test	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable Drip Test	IEC 60794-1-21, 60794-2,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.
17	Abrasion Resistance Test	IEC 60794-1-21, 60794-2,	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.	

18	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C. TB1 temperature: + 60°C. TB2 temperature: + 70°C. No. of temperature cycle: 2 Time at each temperature: 12hrs.	
19		Cable Aging test	IEC 60794-1-22, 60794-2,	Change in attenuation at 1550nm: $\leq$ 0.05dB, when cable is exposed to 85 °C $\pm$ 2 °C for a minimum of 168 hours.	
20		Water Blocking Test	IEC 60794-1-22, 60794-2,	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
21		UV Radiation Test	IEC 60068-2-1, ASTM G-154-12a, IEC 60794-1-22 Method F14,	Type of lamp: 40watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours There should not be any fading or change in colour of the sheath.	
22		Check of the effect of aggression media on the cable	ISO175	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on	

				the sheath and other markings of the cables. The sample should not show any effect of these solutions on the sheath and other marking of the cable	
23		Cable Material Compatibility	Telecordia GR 20, IEC60794	Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all raw materials are same in one of the cable design, then this test shall be skipped based on prior result.
24	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
25		Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
26		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
27		Strippability and access to the fiber – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
28		Strippability and access to the fiber - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails,	Applicable for Micromodule only.

				and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after this operation.	
29	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
30	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	<ul> <li>Breakout shall be accomplished without specialized tools or apparatus.</li> <li>The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;</li> <li>Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.</li> </ul>	Applicable for Ribbon Fibre Only
31		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
32		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
33		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
34		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only

35		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre Only
36	Geometrical Characteristics of Fibre used in	Mode Field Diameter at 1310 nm /1550 nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
37	the cable	Cladding Diameter	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
38		Cladding Non-circularity	Do	Do	Do
39		Core Clad concentricity error	Do	Do	Do
40		Coating diameter	IEC 60793-2-50, 60793-1-21,	Do	Do
41		Coating /Cladding concentricity	IEC 60793-2-50, 60793-1-21,	Do	Do
42	Transmission Characteristics of Fibre used in the	At 1550nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
43	Cable (Chromatic Dispersion)	At 1625nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
44		In 1285-1330nm band	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
45		In 1270-1340nm band	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
46		Zero Dispersion slope	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
47		Zero Dispersion wavelength range	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do

48	Transmission	Change in attenuation	ITU-T G.657.A,	As per Annexure to TEC ER No:	Applicable to respective type of
70	Characteristics	when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.A1 &	Optical fibre used in the cable as
	of Fibre used in	10 turns on 15 mm radius	60793-2-50, 60793-1-	G.657.A2 type of Optical fibre used	per ITU-T G.652.A
	the cable	mandrel	47	in the cable	per 11 0-1 G.032.A
49	(Fibre Macro	Change in attenuation	ITU-T G.657. A,	As per Annexure to TEC ER No:	Applicable to respective type of
49	bend loss)	when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.A1,	Optical fibre used in the cable as
	Della 1088)	1 turn on 10 mm radius	60793-2-50, 60793-1-	G.657.A2 & G.657.B3 type of	per ITU-T G.652.A & G.657.B
		mandrel	47	Optical fibre used in the cable	per 11 U-1 G.632.A & G.637.B
50			ITU-T G.657.A &	1	A
50		Change in attenuation		As per Annexure to TEC ER No:	Applicable to respective type of
		when fibre is coiled with	G.657.B, G.650.1 and	TEC70012008 for G.657.A2 &	Optical fibre used in the cable as
		1 turn on 7.5 mm radius	IEC 60793-2-50,	G.657.B3 type of Optical fibre used	per ITU-T G.652.A & G.657.B
		mandrel	60793-1-47, Annex R1	in the cable	
51		Change in attenuation	ITU-T G.657.B,	As per Annexure to TEC ER No:	Applicable to respective type of
		when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.B3 type	Optical fibre used in the cable as
		1 turn on 5 mm radius	60793-2-50, 60793-1-	of Optical fibre used in the cable	per ITU-T G.657.B
		mandrel	47, Annex R1		
52	Mechanical	Peak Stripability force to	IEC 60793-2-50,	As per Annexure to TEC ER No:	Applicable to respective type of
	Characteristics	remove primary coating	60793-1-32,	TEC70012008 for respective type	Optical fibre used in the cable as
	of Fibre used in	of the fiber (Unaged,		of Optical fibre used in the cable	per ITU-T G.65x
	the cable	Water aged, Damp heat			
		aged)			
53		Fiber Curl	IEC 60793-2-50,		
			60793-1-34,	Do	Do
54	Colour	MEK RUB Test	Draft IEC 60794-1-		
	qualification for	(Methyl Ethyl Ketone)	219,	Do	Do
	color fibres		·		
55	Safety	The material used in the		The manufacturer shall submit	
	Requirement	manufacturing of the OFC		MSDS (Material safety Data Sheet)	
	1	shall be non-toxic and		for all the material used in	
		dermatologically safe in		manufacturing of Optical fibre	
		its life time and shall not		cable to substantiate the	
		be hazardous to health.		requirement.	
		or nazaraous to nearth.		10quitonioni	

# **A4.3** Parameter Group: Optical Fibre Cable –Riser

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km (A1) ≤ 0.37 dB/Km (A2) ≤ 0.37 dB/Km (B3)	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1383nm	Do	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	Do	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	Do	≤ 0.22 dB/Km (A1) ≤ 0.23 dB/Km (A2) ≤ 0.24 dB/Km (B3)	Do
5		Attenuation at 1625nm	Do	≤ 0.25 dB/Km (A) ≤ 0.26 dB/Km (B3)	Do
6		PMD Cabled Loose Fibre	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-48	≤ 0.3 ps/√km	Do
7		PMD Cabled Ribbon Fibre	Do		
8		Cable Cut-off Wavelength	ITU-T G. 657, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550 nm: ≤ 0.05dB when subjected to a Tensile load of 1.3 W or 660 N /1320 N whichever is higher	660N (upto 12 fibre) 1320 N (for 24/48 fibre)
10		Crush Resistance	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 1000N / 500N	1000 N for Tight buffer 500N for Micromodule
11		Impact	IEC 60794-1-21, 60794-2,	Change in attenuation at 1550nm: ≤ 0.05dB.when subjected to Impact of 12.5Nm/6Nm	12.5 J for Tight Buffer 6 J for Micromodule

12		Kink Test	IEC 60794-1-21,	Change in attenuation at 1550nm: \le	There shall be no damage
			60794-2,	0.05dB when subjected to a Kink with	to the sheath or to the
			,	radius of 10D (D - diameter of cable).	cable elements under
					visual examination
					without magnification
13		Bend Test	IEC 60794-1-21,	Change in attenuation at 1550nm: ≤	
			60794-2,	0.05dB when subjected to Bend around a	
				mandrel of diameter of 20D for 10	
				cycles,.	
14		Repeated Bend Test	IEC 60794-1-21,	Change in attenuation at 1550nm: ≤	The bending rate shall be
			60794-2,	0.05dB when cable is flexed with 1 cycle	approximately one cycle
				in 2 sec to 5 sec with	in 2s to 5s and cable shall
				Pulley diameter of 20D (D- diameter of	be free from any optical
				cable) and Load of 5Kg	& visual physical damage.
15		Torsion Test	IEC 60794-1-21,	Change in attenuation at 1550nm: ≤	Cable shall be free from
			60794-2,	0.05dB when subjected to Torsion with a	any optical & visual
				load of 100N for 10 cycles.	physical damage.
16		Abrasion Resistance Test	IEC 60794-1-21,	Steel needle diameter $d = 1.0$ mm, load: 4	
			60794-2,	N, No perforation & loss of legibility of	
				the marking on the sheath.	
17	Environmental	Temperature Cycling	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
	Characteristics		60794-2,	0.05dB when subjected to following	
				temperature cycle:	
				TA2 temperature: - 20°C	
				TA1 temperature: - 10°C.	
				TB1 temperature: + 60°C.	
				TB2 temperature: + 70°C.	
				No. of temperature cycle: 2	
				Time at each temperature : 12hrs.	
18		Cable Aging test	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
			60794-2	0.05dB, when cable is exposed to 85 $^{\circ}$ C $\pm$	
				2 °C for a minimum of 168 hours.	
19		Termite and Rodent Test	Annex R1	Following minimum parametric test for	No Indian/Global
				Anti-termite dopant shall be carried out	standard. One similar
				- Non- toxicity	standard is under draft

				<ul><li>Thermal Stability</li><li>Long life span/half-life</li><li>Efficacy</li></ul>	stage in IEC forum. This test maybe taken up as per IEC, once IEC finalises its standard.
20		Check of the effect of aggression media on the cable	ISO175	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables.  The sample should not show any effect of these solutions on the sheath and other marking of the cable	
21		Cable Material Compatibility	Telecordia GR 20, IEC60794	Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all RM are same in one of the cable design, then this test shall be skipped based on prior result.
22	Characteristics of Cable Elements	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
23	(Buffer Tube)	Strippability test - Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
24		Strippability test - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over	Applicable for Micromodule only.

				at least 10 cm to expose the end fibres. The fibres must retain their mechanical	
				strength after this operation.	
25	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
26	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	<ul> <li>Breakout shall be accomplished without specialized tools or apparatus.</li> <li>The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;</li> <li>Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.</li> </ul>	Applicable for Ribbon Fibre Only
27		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
28		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
29		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
30		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : $\leq$ 0.05 dB	Applicable for Ribbon Fibre Only
31		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre Only
32	Geometrical Characteristics of Fibre used in the cable	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
33		Cladding Diameter	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do

34		Cladding Non-circularity	Do	Do	Do
35		Core Clad concentricity	Do	Do	Do
		error			
36		Coating diameter	IEC 60793-2-50,		
			60793-1-21,	Do	Do
37		Coating /Cladding	IEC 60793-2-50,		
		concentricity	60793-1-21,	Do	Do
38	Transmission	At 1550nm	ITU-T G.657, G.650.1	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics		and IEC 60793-2-50,	TEC70012008 for respective type of	type of Optical fibre used
	of Fibre used in		60793-1-42,	Optical fibre used in the cable	in the cable as per ITU-T
	the Cable				G.65x
39	(Chromatic	At 1625nm	ITU-T G.657, G.650.1		
	Dispersion)		and IEC 60793-2-50,	Do	Do
			60793-1-42,		
40		In 1285-1330nm band	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
41		In 1270-1340nm band	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
42		Zero Dispersion slope	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
43		Zero Dispersion	ITU-T G.657, G.650.1		
		wavelength range	and IEC 60793-2-50,	Do	Do
			60793-1-42,		
44	Transmission	Change in attenuation	ITU-T G.657.A,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.A1 & G.657.A2	type of Optical fibre used
	of Fibre used	10 turns on 15 mm radius	60793-2-50, 60793-1-47	type of Optical fibre used in the cable	in the cable as per ITU-T
	in the cable	mandrel	200,00720117		G.652.A
45	(Fibre Macro	Change in attenuation	ITU-T G.657. A ,	As per Annexure to TEC ER No:	Applicable to respective
	bend loss)	when fibre is coiled with 1	G.650.1 and IEC	TEC70012008 for G.657.A1, G.657.A2 &	type of Optical fibre used
		turn on 10 mm radius	60793-2-50, 60793-1-47	G.657.B3 type of Optical fibre used in the	in the cable as per ITU-T
		mandrel	23.75 2 53, 55775 1 17	cable	G.652.A & G.657.B

46		Change in attenuation	ITU-T G.657.A &	As per Annexure to TEC ER No:	Applicable to respective
		when fibre is coiled with 1	G.657.B, G.650.1 and	TEC70012008 for G.657.A2 & G.657.B3	type of Optical fibre used
		turn on 7.5 mm radius	IEC 60793-2-50,	type of Optical fibre used in the cable	in the cable as per ITU-T
		mandrel	60793-1-47, Annex R1	37	G.652.A & G.657.B
47		Change in attenuation	ITU-T G.657.B,	As per Annexure to TEC ER No:	Applicable to respective
		when fibre is coiled with 1	G.650.1 and	TEC70012008 for G.657.B3 type of	type of Optical fibre used
		turn on 5 mm radius	IEC 60793-2-50,	Optical fibre used in the cable	in the cable as per ITU-T
		mandrel	60793-1-47		G.657.B
			Annex R1		
48	Mechanical	Peak Stripability force to	IEC 60793-2-50,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	remove primary coating of	60793-1-32,	TEC70012008 for respective type of	type of Optical fibre used
	of Fibre used	the fiber (Unaged, Water		Optical fibre used in the cable	in the cable as per ITU-T
	in the cable	aged, Damp heat aged)			G.65x
		Fiber Curl	IEC 60793-2-50,		
49			60793-1-34,	Do	Do
50	Colour	MEK RUB Test	Draft IEC 60794-1-219,		
	qualification	(Methyl Ethyl Ketone)		Do	Do
	for color fibres				
51	Safety	Flame Spread-Single	IEC/EN 60332-1-2	Char less than 0.54 m at completion of	
	Requirements	cable		test	
52		Flame Spread- Bunched	IEC/EN 60332-3-24:	Char less than 2.5 m at completion of the	
		cable	2018, Cat C	test	
53		Smoke Test	IEC/EN 61034-2	Minimum transmittance 60%	
54		Acid gas (Toxicity) (Test	IEC/EN 60754-2	pH not less than 4.3	
		on toxic gases evolved		Conductivity not more than 10 µS/mm	
		during combustion of			
		materials from cables)			
55		The material used in the		The manufacturer shall submit MSDS	
		manufacturing of the OFC		(Material safety Data Sheet) for all the	
		shall be non-toxic and		material used in manufacturing of Optical	
		dermatologically safe in		fibre cable to substantiate the requirement.	
		its life time and shall not			
		be hazardous to health.			

# **A4.4** Parameter Group: Optical Fibre Cables -Indoor/Outdoor

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km (A1) ≤ 0.37 dB/Km (A2) ≤ 0.37 dB/Km (B3)	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1383nm	Do	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	Do	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	Do	≤ 0.22 dB/Km (A1) ≤ 0.23 dB/Km (A2) ≤ 0.24 dB/Km (B3)	Do
5		Attenuation at 1625nm	Do	≤ 0.25 dB/Km (A) ≤ 0.26 dB/Km (B3)	Do
6		PMD Cabled Loose Fibre	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	Do	≤ 0.3 ps/√km	Do
8		Cable Cut-off Wavelength	ITU-T G. 657, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550 nm: ≤ 0.05dB when subjected to a Tensile load of 1.3 W or 500 N which is higher	
10		Crush Resistance	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm : ≤ 0.05dB when subjected to a compressive load of 1000 N.	

11		Impact	IEC 60794-1-21, 60794-3, 60794-3-10,	Change in attenuation at 1550nm : ≤ 0.05dB.when subjected to Impact of 12.5	
12		Kink Test	60794-3-11, IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Nm Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13		Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	_
14		Repeated Bend Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15		Torsion Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16		Cable Drip Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry- Dry Cable Design.
17		Abrasion Resistance Test	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11,	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.	
18	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C.	

			TD1 4 (00C	
			TB1 temperature: $+60^{\circ}$ C.	
			TB2 temperature: + 70°C.	
			No. of temperature cycle : 2	
	244		Time at each temperature : 12hrs.	
19	Cable Aging test	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
		60794-3, 60794-3-10,	0.05dB, when cable is exposed to 85 $^{\circ}$ C $\pm$	
		60794-3-11	2 °C for a minimum of 168 hours.	
20	Water Blocking Test	IEC 60794-1-22,	Test duration: 168 hour	No water shall be detected
		60794-3, 60794-3-10,	Sample length: 3 m	at the unsealed end of the
		60794-3-11	Water Head Height: 1m	sample. If a fluorescent
			No dye shall be detected when the end of	dye is used, an ultraviolet
			the 3m length is examined with ultraviolet	light may be used for the
			light detector. The cable sample under test	examination.
			for 7 days, shall be ripped open after the	
			test and then it shall be examined for	
			seepage of water into the cable and it shall	
			not be more than 20cm.	
21	UV Radiation Test	IEC 60068-2-1, ASTM	Type of lamp: 40watt UV-B lamp with	
		G-154-12a, IEC	peak emission at 313nm.	
		60794-1-22 Method	Duration: 2000 hours	
		F14,	There should not be any fading or change	
			in colour of the sheath.	
22	Termite and Rodent Test	Annex R1	Following minimum parametric test for	No Indian/Global
			Anti-termite dopant shall be carried out	standard. One similar
			- Non- toxicity	standard is under draft
			- Thermal Stability	stage in IEC forum. This
			- Long life span/half-life	test maybe taken up as per
			- Efficacy	IEC, once IEC finalises
				its standard.
23	Check of the effect of	ISO175	The test samples are put in the PH4 and	The state of the s
23	aggression media on the	150175	PH10 solutions separately. After 30 days	
	cable		these samples are taken out from the	
	Cabic		solutions and examined for any corrosion	
			etc. on the sheath and other markings of	
			the cables.	
			the cables.	

				The sample should not show any effect of these solutions on the sheath and other	
24		Cable Material Compatibility	Telecordia GR 20, IEC60794	marking of the cable  Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable.  If all RM are same in one of the cable design, then this test shall be skipped based on prior result.
25	Characteristics of Cable Elements (Buffer	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
26	Tube)	Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
27		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
28		Strippability and access to the fiber – Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
29		Strippability and access to the fiber - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over at least 10 cm to expose the end fibres.	Applicable for Micromodule only.

				The fibres must retain their mechanical strength after this operation.	
30	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
31	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	<ul> <li>Breakout shall be accomplished without specialized tools or apparatus.</li> <li>The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;</li> <li>Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.</li> </ul>	Applicable for Ribbon Fibre Only
32		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
33		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
34		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
35		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : ≤ 0.05 dB	Applicable for Ribbon Fibre Only
36		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre Only
37	Geometrical Characteristics of Fibre used in the cable	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
38		Cladding Diameter	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do

39		Cladding Non-			
		circularity	Do	Do	Do
40		Core Clad concentricity			
		error	Do	Do	Do
41		Coating diameter	IEC 60793-2-50,		
			60793-1-21,	Do	Do
42		Coating /Cladding	IEC 60793-2-50,		
		concentricity	60793-1-21,	Do	Do
43	Transmission	At 1550nm	ITU-T G.657, G.650.1	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics of		and IEC 60793-2-50,	TEC70012008 for respective type of	type of Optical fibre used
	Fibre used in the		60793-1-42,	Optical fibre used in the cable	in the cable as per ITU-T
	Cable (Chromatic				G.65x
44	Dispersion)	At 1625nm	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
45		In 1285-1330nm band	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
46		In 1270-1340nm band	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
47		Zero Dispersion slope	ITU-T G.657, G.650.1		
			and IEC 60793-2-50,	Do	Do
			60793-1-42,		
48		Zero Dispersion	ITU-T G.657, G.650.1		
		wavelength range	and IEC 60793-2-50,	Do	Do
			60793-1-42,		
49	Transmission	Change in attenuation	ITU-T G.657.A,	As per Annexure to TEC ER No:	Applicable to respective
	Characteristics	when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.A1 & G.657.A2	type of Optical fibre used
	of Fibre used in	10 turns on 15 mm radius	60793-2-50, 60793-1-	type of Optical fibre used in the cable	in the cable as per ITU-T
	the cable	mandrel	47		G.652.A
50	(Fibre Macro	Change in attenuation	ITU-T G.657. A,	As per Annexure to TEC ER No:	Applicable to respective
	bend loss)	when fibre is coiled with	G.650.1 and IEC	TEC70012008 for G.657.A1, G.657.A2 &	type of Optical fibre used
		1 turn on 10 mm radius	60793-2-50, 60793-1-	G.657.B3 type of Optical fibre used in the	in the cable as per ITU-T
		mandrel	47	cable	G.652.A & G.657.B

51		Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
52		Change in attenuation when fibre is coiled with 1 turn on 5 mm radius mandrel	ITU-T G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47		
53	Mechanical Characteristics of Fibre used in the cable	Peak Stripability force to remove primary coating of the fiber (Unaged, Water aged, Damp heat aged)	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
54		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
55	Colour qualification for color fibres	MEK RUB Test (Methyl Ethyl Ketone)	Draft IEC 60794-1- 219,	Do	Do
56	Safety Requirement	Flame Spread-Single cable	IEC/EN 60332-1-2	Char less than 0.54 m at completion of test	
57	-	Flame Spread- Bunched cable	IEC/EN 60332-3-24: 2018, Cat C	Char less than 2.5 m at completion of the test	
58		Smoke Test	IEC/EN 61034-2	Minimum transmittance 60%	
59		Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables)	IEC/EN 60754-2	pH not less than 4.3 Conductivity not more than 10 μS/mm	
60		The material used in the manufacturing of the OFC shall be non-toxic and dermatologically safe in its life time and shall not be hazardous to health.		The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of Optical fibre cable to substantiate the requirement.	

#### **A4.5** Parameter Group: Optical Fibre Cable – In-home

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values (as per ITU-T L.111)	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km (A1) ≤ 0.37 dB/Km (A2) ≤ 0.37 dB/Km (B3)	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1383nm	Do	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	Do	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	Do	≤ 0.22 dB/Km (A1) ≤ 0.23 dB/Km (A2) ≤ 0.24 dB/Km (B3)	Do
5		Attenuation at 1625nm	Do	≤ 0.25 dB/Km (A) ≤ 0.26 dB/Km (B3)	Do
6		PMD Cabled Loose Fibre	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	Do	≤ 0.3 ps/√km	Do
8		Cable Cut-off Wavelength	ITU-T G. 657, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21, ITU-T Rec. L.111	Length under test:0.5 m. Test loads: rated tensile load, TS = 5 N, long term load, TL = 30 % of TS. Attenuation change: no change at 1550nm No fibre and cable breakage.	
10		Crush Resistance	IEC 60794-1-21, ITU-T Rec. L.111	Compressive force: 490 N/ 100 mm. Compression time:1 min.	

			Attenuation change: 0.20 dB under
			the load, no change after test at 1550
	_		nm. No fibre and cable breakage.
11	Impact	IEC 60794-1-21,	Impact energy:
		ITU-T Rec. L.111	0.3 kg at 0.1 m height.
			Hammer: flat hammer.
			Number/location of impacts: 3 places
			separated at least 0.5 m, 1 impacts at
			each place.
			Maximum attenuation change: no
			change after the test at 1550 nm.
			No fibre and cable breakage, imprint
			on cable could be compromised.
12	Kink Test	IEC 60794-1-21,	Minimum bend diameter: as per
	=====================================	ITU-T Rec. L.111	6.2.1/L.111
		110 1100 2011	No kink and fibre/cable breakage.
13	Bend Test	IEC 60794-1-21,	Number of turns in the helix: 4
		ITU-T Rec. L.111	Mandrel diameter: minimum bend
			diameter (as per 6.2.1/L.111) + 10 %.
			Test temperature: -10 °C.
			Maximum attenuation change: 0.20
			dB during the test, no change after
			the test at 1550 nm.
			No fibre and cable breakage.
14	Repeated Bend Test	IEC 60794-1-21,	Number of cycles: 10.
1.	Repeated Bend Test	ITU-T Rec. L.111	Tensioning: minimum tension;
		110 1 Rec. E.111	support the specimen as needed.
			Bending radius: per 6.2.1.
			Maximum attenuation change: no
			change after the test at 1550 nm.
			No fibre and cable breakage.
15	Torsion Test	IEC 60794-1-21,	Test gauge length: 0.5 m.
13	TOISIOII TEST	IEC 60/94-1-21, ITU-T Rec. L.111	
		11U-1 Kec. L.111	Tensioning: minimum tension;
			support the specimen as needed.

				Attenuation change: no change at	
				1550 nm	
				No fibre and cable breakage.	
16	Environmental	Temperature Cycling	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
	Characteristics		ITU-T Rec. L.111	0.05dB when subjected to following	
				temperature cycle:	
				TA2 temperature: - 20°C	
				TA1 temperature: - 10°C.	
				TB1 temperature: + 60°C.	
				TB2 temperature: + 70°C.	
				No. of temperature cycle: 2	
				Time at each temperature : 12hrs.	
17		Cable Aging test	IEC 60794-1-22,	Change in attenuation at 1550nm: ≤	
			ITU-T Rec. L.111	0.05dB, when cable is exposed to 85	
				$^{\circ}$ C $\pm$ 2 $^{\circ}$ C for a minimum of 168	
				hours.	
18		Damp Heat Test	IEC 60793-1-50	Change in attenuation at 1550 nm: ≤	
			ITU-T Rec. L.111	0.05dB when exposed to	
				Temperature : 40°C±2°C	
				Relative humidity: 95%	
				Time: 96h	
19		Check of the effect of	ISO175	The test samples are put in the PH4	
		aggression media on the		and PH10 solutions separately. After	
		cable		30 days these samples are taken out	
				from the solutions and examined for	
				any corrosion etc. on the sheath and	
				other markings of the cables.	
				The sample should not show any	
				effect of these solutions on the sheath	
				and other marking of the cable	
20		Cable Material	Telecordia GR 20, IEC60794	Optical fibre, buffers/core tubes, and	Applicable as per IEC
		Compatibility		other core components shall meet the	60794-1-219 (draft) to
				requirements of the compatibility	control the quality of
				with buffer/core tube filling	material and life span of
				material(s) and/or water-blocking	the cable.

21	Geometrical Characteristics	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-45	materials that are in direct contact with identified components within the cable structure  As per Annexure to TEC ER No: TEC70012008 for respective type of	If all RM are same in one of the cable design, then this test shall be skipped based on prior result.  Applicable to respective type of Optical fibre
	of Fibre used in the cable			Optical fibre used in the cable	used in the cable as per ITU-T G.657
22		Cladding Diameter	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-20,	Do	Do
23		Cladding Non- circularity	Do	Do	Do
24		Core Clad concentricity error	Do	Do	Do
25		Coating diameter	IEC 60793-2-50, 60793-1-21,	Do	Do
26		Coating /Cladding concentricity	IEC 60793-2-50, 60793-1-21,	Do	Do
27	Transmission Characteristics of Fibre used in the Cable	At 1550nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
28	(Chromatic Dispersion)	At 1625nm	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
29	-	In 1285-1330nm band	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
30		In 1270-1340nm band	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
31		Zero Dispersion slope	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
32		Zero Dispersion wavelength range	ITU-T G.657, G.650.1 and IEC 60793-2-50, 60793-1-42,	Do	Do
33	Transmission Characteristics	Change in attenuation when fibre is coiled with	ITU-T G.657.A, G.650.1 and IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A1 &	Applicable to respective type of Optical fibre

	of Fibre used in	10 turns on 15 mm radius		G.657.A2 type of Optical fibre used	used in the cable as per
	the cable	mandrel		in the cable	ITU-T G.652.A
34	(Fibre Macro bend loss)	Change in attenuation when fibre is coiled with 1 turn on 10 mm radius mandrel	ITU-T G.657. A , G.650.1 and IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
35		Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47, Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
36		Change in attenuation when fibre is coiled with 1 turn on 5 mm radius mandrel	ITU-T G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47 Annex R1	As per Annexure to TEC ER No: TEC70012008 for G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.B
37	Mechanical Characteristics of Fibre used in the cable	Peak Stripability force to remove primary coating of the fiber (Unaged, Water aged, Damp heat aged)	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable Striping length: 15 mm, Stripping force: 5~18 N (if the primary and secondary coating are removed together.)	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
38		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
39	Colour qualification for color fibres	MEK RUB Test (Methyl Ethyl Ketone)	Draft IEC 60794-1-219,	Do	Do
40	Safety Requirement	Flame retardant	IEC TR62222 IEC 60332-1-2	Flame retardant should meet fire safety regulations	
41		Flame Spread-Single cable	IEC/EN 60332-1-2	Char less than 0.54 m at completion of test	
42		Flame Spread- Bunched cable	IEC/EN 60332-3-24: 2018, Cat C	Char less than 2.5 m at completion of the test	

43	Smoke Test	IEC/EN 61034-2	Minimum transmittance 60%	
44	Acid gas (Toxicity) (Test	IEC/EN 60754-2	pH not less than 4.3	
	on toxic gases evolved		Conductivity not more than 10	
	during combustion of		μS/mm	
	materials from cables)			
45	The material used in the		The manufacturer shall submit	
	manufacturing of the OFC		MSDS (Material safety Data Sheet)	
	shall be non-toxic and		for all the material used in	
	dermatologically safe in		manufacturing of Optical fibre cable	
	its life time and shall not		to substantiate the requirement.	
	be hazardous to health.			

# **Annexure-Tx-A5-OFC: Optical Fibre Cables for Direct Surface Application (DSA)**

#### **A5.1 Parameter Group:** Optical Fibre Cable –DSA

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values (as per ITU-T Rec. L.110)	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	$\leq$ 0.3 ps/ $\sqrt{km}$	Do
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550 nm: ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of 3500 Newton	

10	Crush Resistance	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a compressive load of 5000 N	
11	Impact	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Impact of 25N	
12	Kink Test	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend Test	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14	Repeated Bend Test	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2sec to 5sec with Pulley diameter of 20D (D- diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsion Test	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable Drip Test	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.
17	Abrasion Resistance Test	ITU-T Rec. L.110 IEC 60794-1-21, 60794-3-70,	Steel needle diameter d = 1.0 mm, load: 4 N No perforation & loss of legibility of the marking on the sheath.	

18	Environmental Characteristics	Temperature Cycling	ITU-T Rec. L.110 IEC 60794-1-22, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C. TB1 temperature: + 60°C. TB2 temperature: + 70°C. No. of temperature cycle: 2 Time at each temperature: 12hrs.	
19		Cable Aging test	ITU-T Rec. L.110 IEC 60794-1-22, 60794-3-70,	Change in attenuation at 1550nm: ≤ 0.05dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
20		Water Blocking Test	ITU-T Rec. L.110 IEC 60794-1-22, 60794-3-70,	Test duration: 168 hour Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined with ultraviolet light detector. The cable sample under test for 7 days, shall be ripped open after the test and then it shall be examined for seepage of water into the cable and it shall not be more than 20 cm.	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
21		UV Radiation Test	ITU-T Rec. L.110 IEC 60068-2-1, , ISO4892-2, ASTM G-154-12a, IEC 60794-1-22 Method F14,	Type of lamp: 40watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours There should not be any fading or change in colour of the sheath.	
22		Lightning Test	ITU-T Rec. L.110 FOTP-181, ITU-T K-47	The cable shall withstand the current level of greater than 105 K. Amp. There shall not be any damage to the fibre & Inner Sheath of the cable and	Applicable for Armoured cable.

23		Termite and Rodent Test		change in attenuation of the fibre after the test shall be < 0.05 dB for 1550 nm.  Following minimum parametric test for Anti-termite dopant shall be carried out  Non-toxicity  Thermal Stability  Long life span/half-life  Efficacy	No Indian/Global standard. One similar standard is under draft stage in IEC forum. This test maybe taken up as per IEC, once IEC finalises its standard.
24		Check of the effect of aggression media on the cable	ISO175	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables. The sample should not show any effect of these solutions on the sheath and other marking of the cable	
25		Cable Material Compatibility	Telecordia GR 20, IEC 60794-3-11	Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure	Applicable as per IEC 60794-1-219 (draft) to control the quality of material and life span of the cable. If all RM are same in one of the cable design, then this test shall be skipped based on prior result.
26		Electrical continuity test	ITU-T Rec. L.110 IEC 60794-1-24, IEC 60794- 3-11	The metallic elements shall be continuous.	Applicable for Armoured cable.
27	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.

28		Drainage Test/Compound	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a	Applicable to jelly filled Loose tube and Micromodule
29		Flow Watertightness /	IEC 60794-1-22, IEC 60794-3	period of 24 Hrs.  No water shall be detected at the	Not applicable for Dry Tube. Applicable for all type of
		Water Blocking test	60794-3-11	unsealed end of the sample. If a fluorescent dye is used, an ultraviolet	Loose tube, Tight buffer and Micromodule.
				light may be used for the examination.	
30		Strippability test - Tight Buffer	IEC 60794-3, IEC 60793-1-32,	3 mm length of outer sheath of tight buffer at a distance 30 mm from the	Applicable for Tight Buffer only.
			IEC 60793-1-32:2010	end of the tight buffer, leaving the fibre undamaged	
31		Strippability test - Micromodule	-	It must be possible to remove the sheath manually by squeezing it	Applicable for Micromodule only.
		<u>wireromodure</u>		between two fingers without	omy.
				pinching it with your finger nails, and pulling on each side of the	
				required break point. Once the sheath	
				has been broken, it must slide easily over at least 10 cm to expose the end	
				fibres. The fibres must retain their	
				mechanical strength after this	
32	Characteristics	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	operation.  As per IEC standard of different fibre	Applicable for Ribbon Fibre
32	of Cable	Kibbon Dimension	1EC 00/94-1-25, IEC 00/94-5	count Ribbon	Only
33	Elements	Separability of	IEC 60794-1-23, IEC 60794-3	- Breakout shall be accomplished	Applicable for Ribbon Fibre
	(Ribboned Fibre)	individual fibres from ribbon		without specialized tools or apparatus.	Only
	11010)	Hores from Hoodi		- The fibre breakout procedure shall	
				not be permanently detrimental to the	
				fibre optical and mechanical	
				performance; - Any colour coding of fibres shall	
				remain sufficiently intact to enable	

				individual fibres to be distinguished	
				from each other.	
34		Ribbon Compression	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
		Resistance		subjected to a compressive load of	Only
				$500 \text{ N at } 1550 \text{nm}$ : $\leq 0.05 \text{dB}$ .	
35		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
				subjected to a compressive load of	Only
				$500 \text{ N at } 1550 \text{nm}$ : $\leq 0.05 \text{dB}$ .	
36		Ribbon Torsion	IEC 60794-1-31, IEC 60794-3	Change in attenuation when	Applicable for Ribbon Fibre
		Resistance		subjected to a compressive load of	Only
				$500 \text{ N} \text{ at } 1550 \text{nm}$ : $\leq 0.05 \text{dB}$ .	
37		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped	Applicable for Ribbon Fibre
				on a 60 mm diameter mandrel for 100	Only
				turns at 1550 nm : $\leq$ 0.05 dB	
38		Ribbon Stripability	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre
		Test			Only
39	Geometrical	Mode Field	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics	Diameter at 1310	IEC 60793-2-50, 60793-1-45	TEC70012008 for respective type of	of Optical fibre used in the
	of Fibre used in	nm/1550nm		Optical fibre used in the cable	cable as per ITU-T G.65x
40	the cable	Cladding Diameter	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-20,	Do	Do
41		Cladding Non-	ITU-T G.65x, G.650.1 and		
		circularity	IEC 60793-2-50, 60793-1-20,	Do	Do
42		Core Clad	ITU-T G.65x, G.650.1 and		
		concentricity error	IEC 60793-2-50, 60793-1-20,	Do	Do
43		Coating diameter	IEC 60793-2-50, 60793-1-21,		
				Do	Do
44		Coating /Cladding	IEC 60793-2-50, 60793-1-21,		
		concentricity		Do	Do
45	Transmission	At 1550nm	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics		IEC 60793-2-50, 60793-1-42,	TEC70012008 for respective type of	of Optical fibre used in the
	of Fibre used in			Optical fibre used in the cable	cable as per ITU-T G.65x
46	the Cable	At 1625nm	ITU-T G.65x, G.650.1 and		-
	(Chromatic		IEC 60793-2-50, 60793-1-42,	Do	Do

47	Dispersion)	In 1285-1330nm	ITU-T G.65x, G.650.1 and		
	,	band	IEC 60793-2-50, 60793-1-42,	Do	Do
48		In 1270-1340nm	ITU-T G.65x, G.650.1 and		
		band	IEC 60793-2-50, 60793-1-42,	Do	Do
49		Zero Dispersion	ITU-T G.65x, G.650.1 and		
		slope	IEC 60793-2-50, 60793-1-42,	Do	Do
50		Zero Dispersion	ITU-T G.65x, G.650.1 and		
		wavelength range	IEC 60793-2-50, 60793-1-42,	Do	Do
51	Transmission	Change in	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics	attenuation when	IEC 60793-2-50 and IEC	TEC70012008 for respective type of	of Optical fibre used in the
	of Fibre used in	fiber is coiled with	60793-1-47,	Optical fibre used in the cable	cable as per ITU-T G.65x
	the cable	100 turns on $60 \pm 1.0$			
	(Fibre Macro	mm diameter			
	bend loss)	mandrel			
52		Change in	ITU-T G.65x ,ITU-T G.650.1,		
		attenuation when	IEC 60793-2-50 and IEC	Do	Do
		fiber is coiled with 1	60793-1-47,		
		turn around $32 \pm 0.5$			
		mm diameter			
		mandrel			
53		Change in	ITU-T G.652.D ,ITU-T	As per Annexure to TEC ER No:	Applicable to respective type
		attenuation when	G.650.1, IEC 60793-2-50 and	TEC70012008 for G.652.D type of	of Optical fibre used in the
		fiber is coiled with	IEC 60793-1-47,	Optical fibre used in the cable	cable as per ITU-T G.652.D
		100 turns on 50 $\pm$ 0.5			
		mm diameter			
		mandrel			
54		Change in	ITU-T G.657.A, G.650.1 IEC	As per Annexure to TEC ER No:	Applicable to respective type
		attenuation when	60793-2-50,	TEC70012008 for G.657.A1 &	of Optical fibre used in the
		fibre is coiled with	60793-1-47	G.657.A2 type of Optical fibre used	cable as per ITU-T G.652.A
		10 turns on 15 mm		in the cable	
		radius mandrel			
55		Change in	ITU-T G.657. A & G.657.B,	As per Annexure to TEC ER No:	Applicable to respective type
		attenuation when	G.650.1 and IEC 60793-2-50,	TEC70012008 for G.657.A1,	of Optical fibre used in the
		fibre is coiled with 1	60793-1-47,	G.657.A2 & G.657.B3 type of	cable as per ITU-T G.652.A &
				Optical fibre used in the cable	G.657.B

	Ι	10 1		T	
		turn on 10 mm radius			
		mandrel			
56		Change in	ITU-T G.657.A & G.657.B,	As per Annexure to TEC ER No:	Applicable to respective type
		attenuation when	G.650.1 and IEC 60793-2-50,	TEC70012008 for G.657.A2 &	of Optical fibre used in the
		fibre is coiled with 1	60793-1-47,	G.657.B3 type of Optical fibre used	cable as per ITU-T G.652.A &
		turn on 7.5 mm		in the cable	G.657.B
		radius mandrel			
57		Change in	ITU-T G.657.B, G.650.1 and	As per Annexure to TEC ER No:	Applicable to respective type
		attenuation when	IEC 60793-2-50,	TEC70012008 for G.657.B3 type of	of Optical fibre used in the
		fibre is coiled with 1	60793-1-47	Optical fibre used in the cable	cable as per ITU-T G.657.B
		turn on 5 mm radius			•
		mandrel			
58	Mechanical	Peak Stripability	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No:	Applicable to respective type
	Characteristics	force to remove		TEC70012008 for respective type of	of Optical fibre used in the
	of Fibre used in	primary coating of		Optical fibre used in the cable	cable as per ITU-T G.65x
	the cable	the fiber (Unaged,			•
		Water aged, Damp			
		heat aged)			
59		Fiber Curl	IEC 60793-2-50, 60793-1-34,		
		Tiber curi	120 00773 2 30, 00773 1 3 1,	Do	Do
60	Colour	MEK RUB Test	Draft IEC 60794-1-219,	D.0	20
	qualification	(Methyl Ethyl		Do	Do
	for color fibres	Ketone)			
61	Safety	The material used		The manufacturer shall submit	
	Requirements	in the		MSDS (Material safety Data Sheet)	
		manufacturing of		for all the material used in	
		the OFC shall be		manufacturing of Optical fibre cable	
		non-toxic and		to substantiate the requirement.	
		dermatologically		1	
		safe in its life time			
		and shall not be			
		hazardous to			
		health.			
		neam.			

# **Annexure-Tx-A6-OFC:** Hybrid Cables (Optical and Metallic)

#### **A6.1 Parameter Group:** Hybrid Cables (Optical and Metallic)

SN	Parameter Name	Individual Parameter Name	Standard Name	Limits/Values (as per ITU-T Rec. L.109/ IEC 62807-3 (under study)	Applicability
1	Transmission Characteristics	Attenuation at 1310nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1383nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ attenuation at 1310 nm	Do
3		Attenuation at 1490 nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.26 dB/Km	Do
4		Attenuation at 1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.22 dB/Km	Do
5		Attenuation at 1625nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-40,	≤ 0.25 dB/Km	Do
6		PMD Cabled Loose Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48		
7		PMD Cabled Ribbon Fibre	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-48	≤ 0.3 ps/√km	Do
8		Cable Cut-off Wavelength	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-44	1260nm Max.	Do
9	Mechanical Characteristics	Tensile Strength	ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550 nm ≤ 0.05dB & Fiber strain ≤ 0.25% when subjected to a Tensile load of cable as agreed by user	
10		Crush Resistance	ITU-T Rec. L.109	Change in attenuation at 1550nm: ≤ 0.05dB when	

11 12	Impact Kink T	Test I	IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11 ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11 ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	subjected compressive load of 2000N or as agreed by user  Change in attenuation when subjected to Impact load of 25Nm, at 1550nm: ≤ 0.05dB.  Change in attenuation at 1550nm: ≤ 0.05dB when subjected to a Kink with radius of 10D (D - diameter of cable).	There shall be no damage to the sheath or to the cable elements under visual examination without magnification
13	Bend T	I	ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles,.	
14	Repeat	I	ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D-diameter of cable) and Load of 5Kg	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
15	Torsio	I	ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load of 100N for 10 cycles.	Cable shall be free from any optical & visual physical damage.
16	Cable	I	ITU-T Rec. L.109 IEC 60794-1-21, 60794-3, 60794-3-10, 60794-3-11	Sample is kept vertically with open end downwards in the oven for 24 hours at 70° C and examine the paper placed below the cable for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.	Not applicable for Dry-Dry Cable Design.

17	]	Abrasion Resistance	ITU-T Rec. L.109	Steel needle diameter d = 1.0	
' '		Test	IEC 60794-1-21, 60794-3,	mm, load: 4 N	
		Test	60794-3-10, 60794-3-11	No perforation & loss of	
			00794-3-10, 00794-3-11	legibility of the marking on the	
				sheath.	
18	Environmental	Temperature Cycling	ITU-T Rec. L.109	Change in attenuation at	
10	Characteristics	Temperature Cycling		1550nm: < 0.05dB when	
	Characteristics		IEC 60794-1-22, 60794-3,	<u> </u>	
			60794-3-10, 60794-3-11	subjected to following	
				temperature cycle:	
				TA2 temperature: - 20°C	
				TA1 temperature: - 10°C.	
				TB1 temperature: + 60°C.	
				TB2 temperature: + 70°C.	
				No. of temperature cycle: 2	
				Time at each temperature :	
				12hrs.	
19		Cable Aging test	ITU-T Rec. L.109	Change in attenuation at	
			IEC 60794-1-22, 60794-3,	$1550$ nm: $\leq 0.05$ dB, when cable	
			60794-3-10, 60794-3-11	is exposed to 85 °C $\pm$ 2 °C for a	
				minimum of 168 hours.	
20		Water Blocking Test	ITU-T Rec. L.109	Test duration: 168 hour	No water shall be detected at the
			IEC 60794-1-22, 60794-3,	Sample length: 3 m	unsealed end of the sample. If a
			60794-3-10, 60794-3-11	Water Head Height: 1m	fluorescent dye is used, an
				No dye shall be detected when	ultraviolet light may be used for
				the end of the 3m length is	the examination.
				examined with ultraviolet light	
				detector. The cable sample	
				under test for 7 days, shall be	
				ripped open after the test and	
1				then it shall be examined for	
1				seepage of water into the cable	
				and it shall not be more than 20	
1				cm.	

21	UV Radiation Test	ITU-T Rec. L.109 IEC 60068-2-1, , ISO4892-2, ASTM G-154-12a, IEC 60794-1-22 Method F14,	Type of lamp: 40 watt UV-B lamp with peak emission at 313nm. Duration: 2000 hours There should not be any fading or change in colour of the sheath.	
22	Lightning Test	ITU-T Rec. L.109 FOTP-181, ITU-T K-47	The cable shall withstand the current level of greater than 105 K. Amp. There shall not be any damage to the fibre & Inner Sheath of the cable and change in attenuation of the fibre after the test shall be < 0.05 dB for 1550 nm.	Applicable for Armoured cable.
23	Termite and Rodent Test		Following minimum parametric test for Anti-termite dopant shall be carried out - Non- toxicity - Thermal Stability - Long life span/half-life - Efficacy	No Indian/Global standard. One similar standard is under draft stage in IEC forum. This test maybe taken up as per IEC, once IEC finalises its standard.
24	Check of the effect of aggression media on the cable	ISO175	The test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables. The sample should not show any effect of these solutions on the sheath and other marking of the cable	
25	Cable Material Compatibility	Telecordia GR 20, IEC 60794- 3-11	Optical fibre, buffers/core tubes, and other core components shall	Applicable as per IEC 60794-1-219 (draft) to control the quality

26		Electrical continuity	ITU-T Rec. L.109	meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking materials that are in direct contact with identified components within the cable structure  The metallic elements shall be	of material and life span of the cable.  If all RM are same in one of the cable design, then this test shall be skipped based on prior result.  Applicable for Armoured cable.
		test	IEC 60794-1-24, IEC 60794-3-11	continuous.	
27	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23, IEC 60794-3, 60794-3-11	No damage or kink on surface of tube when tested 4 times with Kink radius less than 15xD, D is the diameter of the tube.	Applicable for all type of Loose tube, Tight Buffer and Micromodule.
28		Drainage Test/Compound Flow	IEC 60794-1-21, IEC 60794-3, 60794-3-11	No Flow shall be detected when tested at a temperature of 70° C for a period of 24 Hrs.	Applicable to jelly filled Loose tube and Micromodule Not applicable for Dry Tube.
29		Watertightness / Water Blocking test	IEC 60794-1-22, IEC 60794-3 60794-3-11	No water shall be detected at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.	Applicable for all type of Loose tube, Tight buffer and Micromodule.
30		Strippability test - Tight Buffer	IEC 60794-3, IEC 60793-1-32, IEC 60793-1-32:2010	3 mm length of outer sheath of tight buffer at a distance 30 mm from the end of the tight buffer, leaving the fibre undamaged	Applicable for Tight Buffer only.
31		Strippability test - Micromodule	-	It must be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it must slide easily over	Applicable for Micromodule only.

				at least 10 cm to expose the end fibres. The fibres must retain their mechanical strength after	
				this operation.	
32	Characteristics of Cable	Ribbon Dimension	IEC 60794-1-23, IEC 60794-3	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
33	Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23, IEC 60794-3	- Breakout shall be accomplished without specialized tools or apparatus The fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance; - Any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.	Applicable for Ribbon Fibre Only
34		Ribbon Compression Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
35		Ribbon Twist Test	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
36		Ribbon Torsion Resistance	IEC 60794-1-31, IEC 60794-3	Change in attenuation when subjected to a compressive load of 500 N at 1550nm: ≤ 0.05dB.	Applicable for Ribbon Fibre Only
37		Ribbon Micro-bend	IEC 60794-1-31, IEC 60794-3	Change in attenuation when wrapped on a 60 mm diameter mandrel for 100 turns at 1550 nm : ≤ 0.05 dB	Applicable for Ribbon Fibre Only
38		Ribbon Stripability Test	IEC 60794-1-21, IEC 60794-3		Applicable for Ribbon Fibre Only
39	Geometrical Characteristics	Mode Field Diameter at 1310 nm/1550nm	ITU-T G.65x, G.650.1 and IEC 60793-2-50, 60793-1-45	As per Annexure to TEC ER No: TEC70012008 for	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x

	of Fibre used in			respective type of Optical fibre	
	the cable			used in the cable	
40		Cladding Diameter	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-20,	Do	Do
41		Cladding Non-	ITU-T G.65x, G.650.1 and		
		circularity	IEC 60793-2-50, 60793-1-20,	Do	Do
42		Core Clad	ITU-T G.65x, G.650.1 and		
		concentricity error	IEC 60793-2-50, 60793-1-20,	Do	Do
43		Coating diameter	IEC 60793-2-50, 60793-1-21,		
				Do	Do
44		Coating /Cladding	IEC 60793-2-50, 60793-1-21,		
		concentricity		Do	Do
45	Transmission	At 1550nm	ITU-T G.65x, G.650.1 and	As per Annexure to TEC ER	Applicable to respective type of
	Characteristics of		IEC 60793-2-50, 60793-1-42,	No: TEC70012008 for	Optical fibre used in the cable
	Fibre used in the			respective type of Optical fibre	as per ITU-T G.65x
	Cable (Chromatic			used in the cable	
46	Dispersion)	At 1625nm	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
47		In 1285-1330nm band	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
48		In 1270-1340nm band	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
49		Zero Dispersion slope	ITU-T G.65x, G.650.1 and		
			IEC 60793-2-50, 60793-1-42,	Do	Do
50		Zero Dispersion	ITU-T G.65x, G.650.1 and	_	_
		wavelength range	IEC 60793-2-50, 60793-1-42,	Do	Do
51	Transmission	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,	As per Annexure to TEC ER	Applicable to respective type of
	Characteristics	when fiber is coiled	IEC 60793-2-50 and IEC	No: TEC70012008 for	Optical fibre used in the cable
	of Fibre used in	with 100 turns on 60	60793-1-47,	respective type of Optical fibre	as per ITU-T G.65x
	the cable	±1.0 mm diameter		used in the cable	
	(Fibre Macro	mandrel	YEVY E. C. C. T. YEVY E. C. C. C. C.		
52	bend loss)	Change in attenuation	ITU-T G.65x ,ITU-T G.650.1,		
		when fiber is coiled	IEC 60793-2-50 and IEC	Do	Do
		with 1 turn around 32	60793-1-47,		

50		± 0.5 mm diameter mandrel	WINN IN CO. (50 P. WINN III.		
53		Change in attenuation when fiber is coiled with 100 turns on 50 ±0.5 mm diameter mandrel	ITU-T G.652.D ,ITU-T G.650.1, IEC 60793-2-50 and IEC 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.652.D type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.D
54		Change in attenuation when fibre is coiled with 10 turns on 15 mm radius mandrel	ITU-T G.657.A, G.650.1 IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.A1 & G.657.A2 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A
55		Change in attenuation when fibre is coiled with 1 turn on 10 mm radius mandrel	ITU-T G.657. A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A1, G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
56		Change in attenuation when fibre is coiled with 1 turn on 7.5 mm radius mandrel	ITU-T G.657.A & G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47,	As per Annexure to TEC ER No: TEC70012008 for G.657.A2 & G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.652.A & G.657.B
57		Change in attenuation when fibre is coiled with 1 turn on 5 mm radius mandrel	ITU-T G.657.B, G.650.1 and IEC 60793-2-50, 60793-1-47	As per Annexure to TEC ER No: TEC70012008 for G.657.B3 type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657.B
58	Mechanical Characteristics of Fibre used in the cable	Peak Stripability force to remove primary coating of the fiber (Unaged, Water aged, Damp heat aged)	IEC 60793-2-50, 60793-1-32,	As per Annexure to TEC ER No: TEC70012008 for respective type of Optical fibre used in the cable	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
59		Fiber Curl	IEC 60793-2-50, 60793-1-34,	Do	Do
60	Colour qualification for color fibres	MEK RUB Test (Methyl Ethyl Ketone)	Draft IEC 60794-1-219,	Do	Do

61	Electrical	As per clause 6.1.2 of	IEC 60228	The cross-section of the metallic	IEC 60228 for following
	Characteristics –	ITÚ-T L.109	IEC 60502-1	wire should be designed	Conductor Strands/Class:
	Power Feeding		IEC 60227-1	according to the transmission	Class 1: Solid conductor
	Wires		IEC 61156-1	voltage, transmission distance	Class 2: Stranded conductor
			IEC 61196-1-10x	and the power consumption.	intended for fixed installation
				•	Class 5: Flexible conductor
			BS EN 50525	Under extreme operating	• Class 6: Very Flexible
			BS EN 60304	conditions, the heat generated by	conductor
				conductors should not make the	
				cable temperature exceed the	Conductor Size/Area
				maximum allowed temperature	(AWG/SQMM) to be decided
				in detailed specifications of the	on Power delivery over
				cable element materials.	distances based on max
					allowable Voltage drop
					TI I I G
					The Insulated Copper
					Conductor Shall be meet the
					Electrical requirement of BS EN 50525
					30323
					Colour Scheme for Conductor
					Insulation shall be as per BS EN
					60304
					Maximum No of Cores: 2 to 12
					cores
					Operating Temp: -10 deg C to
					60 deg C
					Low Voltage Application:
					Low Voltage Application: 12, 24,48 & 57 V DC
					Low & Medium Power (15 W
					to 100 W) Distance support up
					to 100 w) Distance support up to 1000 meter
					to 1000 meter

62	Electromagnetic compatibility	Transfer impedance and Coupling attenuation	IEC 61156-1	Cable shall be electromagnetically complied.	
63	Safety Requirements	Flame Spread-Single cable	IEC/EN 60332-1-2	Char less than 0.54 m at completion of test	
64		Flame Spread- Bunched cable	IEC/EN 60332-3-24: 2018, Cat C	Char less than 2.5 m at completion of the test	
65		Smoke Test	IEC/EN 61034-2 ASTM D5424	Minimum transmittance 60%	ASTM D5424 for Smoke density
66		Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables)	IEC/EN 60754-2,		
67		Requirements for fire performance of Optical/metallic hybrid cables should meet fire safety regulations	IEC TR 62222		Test on electric and optical fibre cables under fire condition
68		The material used in the manufacturing of the OFC shall be nontoxic and dermatologically safe in its life time and shall not be hazardous to health.		The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of Optical fibre cable to substantiate the requirement.	