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, and Optical Ground Wire-OPGW)
Annexure-Tx-A4-OFC:	Optical Fibre Cable for Access Network Applications (Indoor Cable, Access Outdoor 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 Dependent Name	Standard Name	Limits/Values	Applicability
		Parameter Name			
1	Transmission Characteristics	Attenuation at 1310nm	IEC 60793-1-40	\leq 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1550nm	IEC 60793-1-40	\leq 0.22 dB/Km	Do
3		Attenuation at 1625nm	IEC 60793-1-40	$\leq 0.25 \text{ dB/Km}$	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48		
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB & Fiber strain $\leq 0.6\%$ when subjected to a Tensile load of 9.81 x 1.3 W Newton (where, W- mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to a Compressive load of 1500 N/2000N	1500 N (for Un- armoured)
					2000N (for Armoured)

8		Impact	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Impact of 10Nm	3 Impact at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles.	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D-diameter of cable) and Load shall be as per FOTP 104. Total number of cycles be 25.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP-85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: $\leq 0.15 dB$ 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB, when cable is exposed to 85 °C \pm 2 °C for a	

				minimum of 168 hours.	
15		Water Blocking Test / Water Penetration Test	IEC 60794-1-22	Test duration: 24 Hours 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.	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.
16		Termite and Rodent Test	The manufacturer shall submit Undertaking that the Anti-termite/Anti- Rodent dopants used if any, are non-toxic and non-hazardous		
17		Electrical continuity test	IEC 60794-1-24/IEC 60794-1-403	The metallic elements shall be continuous.	Applicable for cable having Metallic Armoured/ metallic Strength element
18	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
19	Characteristics of Cable Elements	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
20	(Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	 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

21		Ribbon Twist Test	Telecordia GR-20/ IEC 60794-1-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only		
22		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only		
23	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.			
24	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall respective type of Option	submit MTCTE Certificate cal fibre used in the cable	in compliance to ER of Optical Fibre(ER No. T	EC70112206) for		
25	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
26	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall respective type of Option	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
27	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
28	Colour qualification for color fibres	The manufacturer shall respective type of Option	submit MTCTE Certificate cal fibre used in the cable	in compliance to ER of Optical Fibre(ER No. T	EC70112206) for		
		OR					
		Test shall be carried as	per IEC 60794-1-219				

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	IEC 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 1550nm	IEC 60793-1-40	\leq 0.22 dB/Km	Do	
3		Attenuation at 1625nm	IEC 60793-1-40	\leq 0.25 dB/Km	Do	
4		PMD Cabled Loose Fibre	IEC 60793-1-48			
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do	
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB & Fiber strain $\leq 0.6\%$ when subjected to a Tensile load of 9.81 x 1 W Newton (where, W - mass of 1 Km of cable in Kg)		
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB when subjected to a compressive load of 500N		
8		Impact	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB when subjected to Impact of 1 Nm	3 Impact at 3 locations	
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles		

10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: \leq 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 shall be as per FOTP 104. Total number of cycles be 25.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP-85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13	Environmental Characteristics	Chvironmental Temperature Cycling IEC 60794-1-22 Change in attent 1550nm: ≤ 0.15 subjected to foll temperature cyc Characteristics Temperature Cycling IEC 60794-1-22 Change in attent 1550nm: ≤ 0.15 subjected to foll temperature cyc TA1 temperature TB1 temperature TB1 temperature TB1 temperature TB2 temperature No. of temperature No. of temperature		Change in attenuation at 1550nm: ≤ 0.15dB 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB, when cable is exposed to 85 °C \pm 2 °C for a minimum of 168 hours.	

15		Water Blocking Test/ Water Penetration Test	IEC 60794-1-22	Test duration: 24 Hours 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.	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.
16		Termite and Rodent Test	The manufacturer shall submit Undertaking that the Anti- termite/Anti-Rodent dopants used if any, are non-toxic and non-hazardous		
17	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
18	Characteristics of Cable Elements	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
19	(Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	 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
20		Ribbon Twist Test	Telecordia GR-20/ IEC 60794-	The ribbon shall not show any	Applicable for

			1-23	separation of individual fibres from the ribbon structure after completion of the twist test.	Ribbon Fibre Only	
21		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550nm: ≤ 0.05dB	Applicable for Ribbon Fibre Only	
22	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.		
23	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
24	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
25	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
26	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
27	Colour qualification for color fibres	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable OR Test shall be carried as per IEC 60794-1-219				

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	IEC 60793-1-40	\leq 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1550nm	IEC 60793-1-40	$\leq 0.22 \text{ dB/Km}$	Do
3		Attenuation at 1625nm	IEC 60793-1-40	$\leq 0.25 \text{ dB/Km}$	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	$< 0.3 \text{ ns}/\sqrt{km}$	Do
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	<u> </u>	
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB & Fiber strain $\leq 0.6\%$ when subjected to a Tensile load of 9.81 x 1.3 W Newton (where, W- mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550 nm : ≤ 0.05 dB when subjected to a compressive load of 2500 N/3500 N	2500 N (for Un-armoured cable) 3500 N (for Armoured cable)
8		Impact	IEC 60794-1-21	Change in attenuation at 1310 & 1550nm: ≤ 0.05 dB when subjected to Impact of 25Nm	3 Impact at 3 locations

9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm:≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles.	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load shall be as per FOTP 104.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
11				Total number of cycles be 25.	
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP- 85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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	Not applicable for Dry-Dry Cable Design.
				impression on the paper.	
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.15dB 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	

15		Water Blocking Test/ Water Penetration Test	IEC 60794-1-22	Test duration: 24 Hours 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.	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.
16		Termite and Rodent Test	The manufacturer shall submit Undertaking that the Anti-termite/ Anti-Rodent dopants used if any, are non-toxic and non-hazardous		
17		Electrical continuity test	IEC 60794-1-24/IEC 60794-1-403	The metallic elements shall be continuous.	Applicable for cable having Metallic Armoured/ metallic Strength element
18	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
19	Characteristics of Cable Elements	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
20	(Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	 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 	Applicable for Ribbon Fibre Only

				distinguished from each other.			
21		Ribbon Twist Test	Telecordia GR-20 /IEC 60794-1-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only		
22		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550 nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only		
23	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.			
24	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall s respective type of Optica	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
25	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
26	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
27	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					

28	Colour qualification for color fibres	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable	
		OR	
	Test shall be carried as per IEC 60794-1-219		

<u>Annexure-Tx-A3-OFC: Optical Fibre Cables for Aerial Applications (ADSS over Power line, ADSS on</u> <u>Aerial alignment and Optical Ground Wire-OPGW)</u>

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

SN	Parameter Name	Individual	Standard Name	Limits/Values	Applicability
		Parameter Name			
1	Transmission Characteristics	Attenuation at 1310nm	IEC 60793-1-40	\leq 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1550nm	IEC 60793-1-40	\leq 0.22 dB/Km	Do
3		Attenuation at 1625nm	IEC 60793-1-40	$\leq 0.25 \text{ dB/Km}$	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48		
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB & Fiber strain ≤ 0.6 % when subjected to following Tensile load (in Newton) for Span Length as under: $\frac{\text{Span Length}}{\leq 50\text{m}} \frac{\text{Tensile Load}}{9.81 \text{ x } 1.5 \text{ W}}$ $\frac{\leq 50\text{m}}{51\text{m} \cdot 100\text{m}} \frac{9.81 \text{ x } 2.0 \text{ W}}{101\text{m} \cdot 150\text{m}} \frac{9.81 \text{ x } 2.5 \text{ W}}{151\text{m} \cdot 200\text{m}} \frac{9.81 \text{ x } 3.0 \text{ W}}{201\text{m} \cdot 300\text{m}} \frac{9.81 \text{ x } 4.0 \text{ W}}{9.81 \text{ x } 6.0 \text{ W}}$ where, W- mass of 1 Km of cable in Kg	

7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB when subjected to a compressive load of 1500 N	
8		Impact	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB when subjected to Impact of 10 Nm	3 Impact at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load shall be as per FOTP 104. Total number of cycles be 25.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP-85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13		Galloping Test	IEC 60794-1-21 / IEEE 1222	Galloping cycles – 10000 The test frequency shall be the single- 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: ≤ 0.05 dB after the test	
14		Electrical Test/ Tracking & Erosion Test	IEC 60794-4-20/ IEEE Std 1222/ASTM D 2309- 97	Tracking on the outside of sheath shall not result in erosion at any point of sheath.	Applicable for ADSS cable with Anti-track PE Jacket over power line $\geq 33 \text{ kV}$
15	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.15 dB when subjected to following temperature cycle: TA2 temperature: - 20°C TA1 temperature: - 10°C TB1 temperature: + 60°C	

				TB2 temperature: $+70^{\circ}C$	
16		Califa A sine (ast	IEC (0704 1 22	No. of temperature cycle : 2	
16		Cable Aging test	IEC 60/94-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB,	
				when cable is exposed to 85 $C \pm 2$ C for a minimum of 168 hours	
17		Water Pleaking	IEC 60704 1 22	Test duration: 24 Hours	No water shall be
17		Tost/Water	IEC 00794-1-22	Sample length: 3 m	detected at the unscaled
		Penetration Test		Water Head Height: 1m	and of the sample. If a
		r chetration rest		No dye shall be detected when the end of the 3m	fluorescent dye is used
				length is examined with ultraviolet light detector	an ultraviolet light may
				Tengin is examined with unuviolet light detector.	be used for the
					examination.
18	Characteristics of	Kink resistance	IEC 60794-1-23	No damage or kink on surface of tube when	Applicable for all type
-	Cable Elements	Test		tested 4 times with Kink radius less than 15xD,	of Loose tube, Tight
	(Buffer Tube)			D is the diameter of the tube.	Buffer and
	(Duffer Tube)				Micromodule.
19	Characteristics of	Ribbon	IEC 60794-1-23	As per IEC standard of different fibre count	Applicable for Ribbon
	Cable Elements	Dimension		Ribbon	Fibre Only
20	(Ribboned Fibre)	Separability of	IEC 60794-1-23	- Breakout shall be accomplished without	Applicable for Ribbon
		individual		specialized tools or apparatus.	Fibre Only
		fibres from ribbon		- The fibre breakout procedure shall not be	
				permanently detrimental to the fibre optical and	
				mechanical performance.	
				incontantear performance,	
				- Any colour coding of fibres shall remain	
				sufficiently intact to enable individual fibres to	
				be distinguished from each other.	
21	-	Ribbon Twist Test	Telecordia GR-20/ IEC	The ribbon shall not show any separation of	Applicable for Ribbon
			60794-1-23	individual fibres from the ribbon structure after	Fibre Only
				completion of the twist test.	
22		Ribbon Torsion	IEC 60794-1-31	Change in attenuation at 1550nm: ≤ 0.05 dB	Applicable for Ribbon
		Resistance			Fibre Only
23	Safety	The material used		The manufacturer shall submit MSDS (Material	
	Requirement	in the		safety Data Sheet) for all the material used in	
		manufacturing of		manufacturing of Optical fibre cable to	
1		the OFC shall be		substantiate the requirement.	

		non-toxicanddermatologicallysafe in its life timeand shall not behazardoustohealth.				
24	Geometrical Characteristics of Fibre used in the cable	he manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for spective type of Optical fibre used in the cable				
25	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
26	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
27	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
28	Colour qualification for color fibres	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable OR Test shall be carried as per IEC 60794-1-219				

A 3.2 Parameter Group: Optical Fibre Cable-ADSS on Aerial alignment

SN	Parameter Name	Individual Parameter	Standard Name	Limits/Values	Applicability
		Name			
1	Transmission Characteristics	Attenuation at 1310nm	IEC 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 1550nm	IEC 60793-1-40	\leq 0.22 dB/Km	Do
3		Attenuation at 1625nm	IEC 60793-1-40	\leq 0.25 dB/Km	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48		
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: \leq 0.05dB & Fiber strain \leq 0.6 % when subjected to following Tensile load (in Newton) for Span Length as under: $\frac{\text{Span Length}}{\leq 50\text{m}} \frac{\text{Tensile Load}}{9.81 \times 1.5 \text{ W}}$ $\frac{\leq 50\text{m}}{51\text{m} \cdot 100\text{m}} \frac{9.81 \times 2.0 \text{ W}}{9.81 \times 2.0 \text{ W}}$ $\frac{101\text{m} \cdot 150\text{m}}{9.81 \times 2.5 \text{ W}}$ $\frac{151\text{m} \cdot 200\text{m}}{9.81 \times 3.0 \text{ W}}$ $\frac{201\text{m} \cdot 300\text{m}}{9.81 \times 4.0 \text{ W}}$ $\frac{>300\text{m}}{9.81 \times 6.0 \text{ W}}$ where, W- mass of 1 Km of cable in Kg	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to a compressive load of 1500N	
8		Impact	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Impact of 10Nm	3 Impact at 3 locations

9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load shall be as per FOTP 104. Total number of cycles be 25.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP-85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13		Galloping Test	IEC 60794-1-21/ IEEE 1222	Galloping cycles – 100000 The test frequency shall be the single-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 1550nm: ≤ 0.05 dB after the test	
14	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: \leq 0.15dB 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	
15		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm:	

				≤ 0.05 dB, when cable is exposed to 85	
16	-	Water Blocking Test/	IEC 60794-1-22	Test duration: 24 Hours	No water shall be
10		Water Penetration Test		Sample length: 3 m	detected at the unsealed
				Water Head Height: 1m	end of the sample. If a
				No dye shall be detected when the end	fluorescent dye is used,
				of the 3m length is examined with	an ultraviolet light may
				ultraviolet light detector.	be used for the
					examination.
17	Characteristics	Kink resistance Test	IEC 60794-1-23	No damage or kink on surface of tube	Applicable for all type
	of Cable			when tested 4 times with Kink radius	of Loose tube, Tight
	Elements (Buffer			less than 15xD, D is the diameter of	Buffer and Micromodule
	Tube)			the tube.	wheromodule.
18	Characteristics	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre	Applicable for Ribbon
10	of Cable	Saparability of	IEC 60704 1 23	Breakout shall be accomplished	Applicable for Pibbon
19	Elements	individual	ILC 00794-1-23	without specialized tools or	Fibre Only
	(Ribboned Fibre)	fibres from ribbon		apparatus.	There only
				The Charles have been a long shall not	
				- The fibre breakout procedure shall not	
				optical and mechanical performance:	
				A set of the set of th	
				- Any colour coding of fibres shall	
				individual fibros to be distinguished	
				from each other	
20		Ribbon Twist Test	Telecordia GR-20/	The ribbon shall not show any separation	Applicable for Ribbon
			IEC 60794-1-23	of individual fibres from the ribbon	Fibre Only
				structure after completion of the twist test.	-
21		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550 nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only
22	Safety	The material used in the		The manufacturer shall submit MSDS	
	Requirement	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 its		fibre cable to substantiate the requirement.	
		life time and shall not be			
		hazardous to health.			

23	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
24	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
25	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
26	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
27 Colour qualification for color fibres		The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable OR Test shall be carried as per IEC 60794-1-219			

SN	Parameter Name	Individual	Standard Name	Limits/Values	Applicability
		Parameter Name			
1	Transmission Characteristics	Attenuation at 1310nm	IEC 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 1550nm	IEC 60793-1-40	\leq 0.22 dB/Km	Do
3		Attenuation at 1625nm	IEC 60793-1-40	\leq 0.25 dB/Km	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48		
5		PMD Cabled Ribbon	IEC 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	
		Fibre		_	Do
6	Mechanical Characteristics	Tensile Strength (Ultimate)	IEEE 1138	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.	
7		Creep Test	IEEE 1138	Elongation of the cable for desired TS should meet the criteria.	
8		Stress Strain Test	IEEE 1138	 (i) The breaking strength of the OPGW cable shall meet or exceed 100% of the RTS of the cable. (ii) Should meet the specified Modulus of elasticity(MOE) value 	
				of the OPGW cable.	
9		Strain Margin Test/ MRDT Test	IEEE 1138	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	
10		Sheave Test	IEEE 1138 /IEC-	(i) The Ovality of the cable or	

A3.3 Parameter Group: Optical Ground Wire - OPGW

		60794- 1-2-E9	optical units at the measured locations shall not exceed 10 %.	
			(ii) There shall be no cracking or breaking of any component of the OPGW cable. This shall be visually examined.	
			(iii) Attenuation shall not be greater than 0.1 dB/test fiber km at 1550nm wavelength	
11	Crush Test	IEEE 1138 / IEC 60794- 1-2-E3	 (i) Ovality of the cable or optical fiber units shall be < 10 %. (ii) There shall be no cracking or breaking of any component of the OPGW cable. This shall be visually examined (iii) Attenuation shall not be greater than 0.05 dB/ fiber at 1550nm wavelength 	
12	Bend Test	IEEE 1138 / IEC 60794-1-2-E11 (Procedure-I)	 (i) There shall be no cracking or breaking of any component of the OPGW cable. This shall be visually examined (ii) Attenuation shall not be greater than 0.05 dB/ fiber at 1550nm wavelength 	
13	Torsion Test/Twist Test	IEEE 1138	 (i) There shall be no cracking or breaking of any component of the OPGW cable. This shall be visually examined. (ii) Attenuation shall not be greater than 0.10 dB/test fiber km at 	

]		1550nm wavelength	
14		Aeolian Vibration Test	IEEE 1138	 (i) There shall be no cracking or breaking of any component of the OPGW cable or the supporting hardware. This shall be visually examined. 	
				(ii) Attenuation shall not be greater than 0.2 dB/test fiber km at 1550nm wavelength	
15		Galloping Test	IEEE 1138	 (i) There shall be no Cracking or breaking of any component of the OPGW cable or the supporting hardware. This shall be visually examined. (ii) Attenuation shall not be greater than 0.2 dB/test fiber km at 1550nm wavelength 	
16		Drip Test	IEEE 1138	At the end of 24 h, the water-blocking compound shall not flow (drip or leak) at 65 °C. Flow quantity should meet the criteria.	
17	Electrical Characteristics	DC Resistance	IEEE 1138	The actual dc resistance of the OPGW cable shall not exceed the dc resistance stated by the manufacturer at the specified temperature.	
18		Short Circuit Test	IEEE 1138 /IEC 60794- 1-2-H1	 (i) Any cracking or breaking of any component of the optical sample shall constitute failure. This assessment is made with the naked eye. (ii) Attenuation shall not be greater than 0.05 dB/test fiber km at 1550nm wavelength (iii) There shall be no birdcaging of any of the strands of the optical sample. (iv) Temperature of any metallic 	

				component and inside of fiber unit shall not exceed the criteria.
19		Lightning Arc Test	IEEE 1138 / IEC 60794-1-402	 (i) After the lightning strike application, the cable sample shall experience no permanent increase in optical attenuation greater than 0.10 dB for the concatenated loop at nominally 1550 nm wavelength.
				(ii) In all five qualifying lightning strike locations, visually, there shall be no damage (holes, cracks, etc.) to the integrity of the metallic tube.
				(iii) The minimum remaining strength of any of the tested cable sections shall be greater than the 70% of the cable RTS
20	Environmental Characteristics	Water Penetration Test	IEEE 1138	 (i) A 1.0 m section of OPGW cable shall be prepared for this test.All components of the cable shall be removed from the fluid-blocked optical fiber unit that contains the optical fibers. (ii) No water shall leak through the open end of the 1.0 m sample. If the first sample fails, one additional 1.0 m sample, taken from a section of OPGW cable immediately adjacent to the first sample, may be tested for acceptance.

21		Temperature Cycle Test	IEEE 1138	Attenuation shall not be greater than 0.2				
				dB/test fiber km at 1550nm wavelength				
22	Safety Requirement	The material used in the		The manufacturer shall submit MSDS				
		manufacturing of the		(Material safety Data Sheet) for all the				
		OFC shall be non-toxic		material used in manufacturing of				
		and dermatologically safe		Optical fibre cable to substantiate the				
		in its life time and shall		requirement.				
		not be hazardous to						
		health.						
23	Geometrical	The manufacturer shall su	bmit MTCTE Certificate	in compliance to ER of Optical Fibre(ER N	o. TEC70112206) for respective			
	Characteristics of	type of Optical fibre used	in the cable					
	Fibre used in the							
	cable							
24	Transmission	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective						
	Characteristics of	type of Optical fibre used in the cable						
	Fibre used in the							
	Cable (Chromatic							
	Dispersion)							
25	Transmission	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective						
	Characteristics of	type of Optical fibre used in the cable						
	Fibre used in the							
	cable (Fibre Macro							
	bend loss)							
26	Mechanical	The manufacturer shall su	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective					
	Characteristics of	type of Optical fibre used in the cable						
	Fibre used in the							
	cable							
27	Colour qualification	The manufacturer shall sub	mit MTCTE Certificate i	n compliance to ER of Optical Fibre(ER No	. TEC70112206) for respective			
	for color fibres	type of Optical fibre used in	n the cable	_	_			
		OR						
		Test shall be carried out as	per IEC 60794-1-219					

Annexure-Tx-A4-OFC: Optical Fibre Cables for Access Network Applications (Indoor Cable, Access Outdoor Cable, Indoor-Outdoor Cable, In-Home Cable)

A4.1 Parameter Group: Optical Fibre Cable –Indoor

SN	Parameter	Individual Parameter	Standard Name	Limits/Values	Applicability
	Name	Name			
1	Transmission Characteristics	Attenuation at 1310nm	IEC 60793-1-40	\leq 0.40 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1550nm	IEC 60793-1-40	\leq 0.30 dB/Km	Do
3		Attenuation at 1625nm	IEC 60793-1-40	\leq 0.40 dB/Km	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48		
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	\leq 0.3 ps/ \sqrt{km}	Do
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB & Fiber strain $\leq 0.6\%$ when subjected to a Tensile load of 9.81 x 1 W Newton (where, W-mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to a compressive load of 1000N	
8		Impact	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Impact of 1 Nm	3 Impact at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: \leq	The bending rate shall be

11		Torsion Test	IEC 60794-1-21	 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 shall be as per FOTP 104. Total number of cycles be 25. Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load as per FOTP- 	approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage. Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	85A for 10 cycles. 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.
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.15 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: \leq 0.05dB, when cable is exposed to 85 °C \pm 2 °C for a minimum of 168 hours.	
15		Water Blocking Test/ Water Penetration Test	IEC 60794-1-22	Test duration: 24 Hours Sample length: 3 m Water Head Height: 1m No dye shall be detected when the end of the 3m length is examined	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

				with ultraviolet light detector.	examination.
16	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
17	Characteristics of Cable Elements	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
18	(Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	 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
19		Ribbon Twist Test	Telecordia GR-20 /IEC 60794-1-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only
20		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550 nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only
21	Safety Requirement	Flame Spread-Single cable/Flame propagation for single cable/Flame retardant test single cable/ Flammability test single cable	IEC 60332-1-2	Char less than 0.54 m at completion of test	
22		Flame Spread- Bunched cable/ Flame propagation for bunched cable/Flame retardant test bunched cable/Flammability test	IEC 60332-3-24, Cat C	Char less than 2.5 m at completion of the test	Applicable for riser applications only

23 Smoke Test/Smoke IEC 61034-2 Minimum transmittance 60% 24 Smoke Test/Smoke density under fire conditions/Smoke density of cable burning IEC 60754-2 pH not less than 4.3 24 Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables)/pH Test/pH & Conductivity/Conductivity Test/Degree of acidity IEC 60754-2 pH not less than 4.3 25 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 26 Geometrical Characteristics of Fibre used in the cable The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable 27 Transmission Characteristics of Fibre used in the cable The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for			hunched cable			
23 Sinoke rest/shoke HEC 61034-2 Minimum transmittance 60% 24 density/Sinoke density under fire conditions/Sinoke density of cable burning HEC 61034-2 pH not less than 4.3 24 Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables)/pH Test/pH & Conductivity/Conductivity HEC 60754-2 pH not less than 4.3 25 The material sfrom cables)/pH Test/Degree of acidity The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in 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 MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable 27 Transmission Characteristics of Fibre used in the cable The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for	22	-	Smalte Test/Smalte	IEC (1024.2	Minimum transmittanes 600/	
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24 Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables)/pH Test/pH & Conductivity/Conductivity Test/DEgree of acidity IEC 60754-2 pH not less than 4.3 Conductivity not more than 10 µS/mm 25 The material sfrom cables)/pH Test/DEgree of acidity The manufacturer shall submit manufacturer shall submit 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 MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable 27 Transmission 27 Transmission		_	density of cable burning			
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Fibre used in the cable respective type of Optical fibre used in the cable		Characteristics of	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for			
cable Characteristics of		Fibre used in the	respective type of Optical fibre used in the cable			
27 Transmission Characteristics of		cable				
Characteristics of	27	Transmission				
		Characteristics of				TECT01100000 6
Fibre used in the		Fibre used in the	The manufacturer shall submit	MICIE Certificate in co	mpliance to ER of Optical Fibre(ER No	1EC/0112206) for
Cable (Chromatic respective type of Optical fibre used in the cable		Cable (Chromatic	respective type of Optical fibro	e used in the cable		
Dispersion)		Dispersion)				
28 Transmission	28	Transmission				
Characteristics of The Control of the Automatic of the Control of		Characteristics of				TECT01100000 6
Fibre used in the		Fibre used in the	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
cable (Fibre respective type of Optical fibre used in the cable		cable (Fibre				
Macro bend loss)		Macro bend loss)				
29 Mechanical	29	Mechanical				
Characteristics of The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for		Characteristics of	The manufacturer shall submit	MTCTE Certificate in co	mpliance to ER of Optical Fibre(ER No	. TEC70112206) for
Fibre used in the respective type of Optical fibre used in the cable		Fibre used in the	respective type of Optical fibro	e used in the cable		,
cable		cable				
30 Colour The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for	30	Colour	The manufacturer shall submit	t MTCTE Certificate in co	mpliance to ER of Optical Fibre(ER No	. TEC70112206) for

qualification for respective type of Optical fibre used in the cable	
color fibres OR	
	Test shall be carried as per IEC 60794-1-219

SN	Parameter Name	Individual Parameter	Standard Name	Limits/Values	Applicability
		Name			
1	Transmission Characteristics	Attenuation at 1310 nm	IEC 60793-1-40	\leq 0.36 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1550 nm	IEC 60793-1-40	\leq 0.22 dB/Km	Do
3		Attenuation at 1625nm	IEC 60793-1-40	\leq 0.25 dB/Km	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	< 0.2 m s/s/1 m	
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/vkm}$	Do
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB & Fiber strain $\leq 0.6\%$ when subjected to a Tensile load of 9.81 x 1 W Newton (where, W- mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550nm: ≤0.05dB when subjected to a compressive load of 500N	
8		Impact	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Impact of 10Nm.	3 Impact at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles.	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with1 cycle in 2 sec to5 sec withPulley diameter of 20D (D-diameter of cable) and Load shallbe as per FOTP 104.Total number of cycles be 25.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP-	Cable shall be free from any optical & visual physical damage.

A4.2 Parameter Group: Optical Fibre Cable- Access Outdoor

				85A for 10 cycles.	
12		Cable Drip Test	IEC 60794-1-22	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.
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.15 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
15		Water Blocking Test/Water Penetration Test	IEC 60794-1-22	Test duration: 24 Hours 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.	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.
16	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
17	Characteristics of Cable Elements	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
18	(Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	- Breakout shall be accomplished without specialized tools or apparatus.	Applicable for Ribbon Fibre Only

				 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. 	
19		Ribbon Twist Test	Telecordia GR-20/ IEC 60794-1-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only
20		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only
21	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.	
22	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall subm type of Optical fibre used in t	it MTCTE Certificate in cor the cable	npliance to ER of Optical Fibre(ER No	o. TEC70112206) for respective
23	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
24	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable			
25	Mechanical	The manufacturer shall subm	at MTCTE Certificate in cor	npliance to ER of Optical Fibre(ER No	b. TEC70112206) for respective

	Characteristics of Fibre used in the cable	type of Optical fibre used in the cable
26	Colour qualification for color fibres	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable
		Test shall be carried out as per IEC 60794-1-219

SN	Parameter Name	Individual Parameter	Standard Name	Limits/Values	Applicability
		Name			
1	Transmission Characteristics	Attenuation at 1310nm	IEC 60793-1-40	$ \leq 0.36 \text{ dB/Km (A1)} \\ \leq 0.37 \text{ dB/Km (A2)} \\ \leq 0.37 \text{ dB/Km (B3)} $	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1550nm	IEC 60793-1-40	$ \leq 0.22 \text{ dB/Km (A1)} \leq 0.23 \text{ dB/Km (A2)} \leq 0.24 \text{ dB/Km (B3)} $	Do
3		Attenuation at 1625nm	IEC 60793-1-40	$\leq 0.25 \text{ dB/Km} (A)$ $\leq 0.26 \text{ dB/Km} (B3)$	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	\leq 0.3 ps/ \sqrt{km}	
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48		Do
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05dB when subjected to a Tensile load of 9.81 x 1W Newton (where, W- mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550nm : ≤ 0.05dB when subjected to a compressive load of 1000 N	
8		Impact	IEC 60794-1-21	Change in attenuation at 1550nm : ≤ 0.05dB when subjected to Impact of 10Nm	3 Impact at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load shall be as per FOTP 104. Total number of cycles be 25.	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.

A4.3 Parameter Group: Optical Fibre Cables - Indoor-Outdoor

11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP- 85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.15 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
15		Water Blocking Test/ Water Penetration Test	IEC 60794-1-22	Test duration: 24 Hours 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.	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.
16	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
17	Characteristics of	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only

18	Cable Elements (Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	- Breakout shall be accomplished without specialized tools or apparatus.	Applicable for Ribbon Fibre Only
				- 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.	
19		Ribbon Twist Test	Telecordia GR-20/ IEC 60794-1-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only
20		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only
21	Safety Requirement	Flame Spread-Single cable/Flame propagation for single cable/Flame retardant test single cable/ Flammability test single cable	IEC 60332-1-2	Char less than 0.54 m at completion of test	Test applicable only for indoor component of the cable in case cable design involves part of main cable to be used as indoor cable
22		Smoke Test/Smoke density/Smoke density under fire conditions/Smoke density of cable burning	IEC 61034-2	Minimum transmittance 60%	Test applicable only for indoor component of the cable in case cable design involves part of main cable to be used as indoor cable
23		Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables) /pH Test/pH & Conductivity/Conductivity Test/Degree of acidity	IEC 60754-2	pH not less than 4.3 Conductivity not more than 10 µS/mm	Test applicable only for indoor component of the cable in case cable design involves part of main cable to be used as indoor cable
24		The material used in the		The manufacturer shall submit MSDS (Material safety Data Sheet) for all the	

		manufacturing of the OFC shall be non-toxic and dermatologically safe in its life time and shall not be hazardous to health.	materi Optica require	al used in manufacturing of al fibre cable to substantiate the ement.				
25	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall submit type of Optical fibre used in th	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
26	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable						
27	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable						
28	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable						
29	Colour qualification for color fibres	The manufacturer shall submittype of Optical fibre used in the OR	t MTCTE Certificate in compliance e cable	to ER of Optical Fibre(ER No.	TEC70112206) for respective			

A4.4 Parameter Group: Optical Fibre Cable – In-home

SN	Parameter Name	Individual Parameter	Standard Name	Limits/Values	Applicability
		Name		(as per ITU-T L.111)	
1	Transmission Characteristics	Attenuation at 1310nm	IEC 60793-1-40	\leq 0.40 dB/Km	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.657
2		Attenuation at 1550nm	IEC 60793-1-40	$\leq 0.30 \text{ dB/Km}$	Do
3		Attenuation at 1625nm	IEC 60793-1-40	$\leq 0.40 \text{ dB/Km}$	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48		
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/}\sqrt{\text{km}}$	Do
6	Mechanical	Tensile Strength	IEC 60794-1-21,	Length under test:0.5 m.	
	Characteristics		/ITU-T Rec. L.111	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.	
7		Crush Resistance	IEC 60794-1-21,	Compressive force: 490 N/ 100 mm.	
			/ITU-T Rec. L.111	Compression time: 1 min.	
				Attenuation change: 0.20 dB under	
				the load, no change after test at 1550	
0	-	Trans a st	IEC (0704 1 21	Inn. No fibre and cable breakage.	
0		Impact	IEC 00/94-1-21,	Hammor: flat hammor	
			/110-1 Ket. L.111	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.	
9	1	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 %.	

		1		1	
				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.	
10		Repeated Bend Test	IEC 60/94-1-21,	Number of cycles: 10.	
			/11U-1 Rec. L.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.	
11		Torsion Test	IEC 60794-1-21,	Test gauge length:0.5 m.	
			/ITU-T Rec. L.111	Tensioning: minimum tension;	
				support the specimen as needed.	
				Attenuation change: no change	
				at 1550 nm	
10				No fibre and cable breakage.	
12	Environmental	Temperature Cycling	IEC 60/94-1-22,	Change in attenuation at 1550nm: (0.15 dD) where while the tail	
	Characteristics		/11U-1 Rec. L.111	≤ 0.15 dB when subjected to	
				TA2 temperature: 20° C TA1	
				temperature: - 10°C TB1	
				temperature: $+ 60^{\circ}$ C TB2	
				temperature: $+70^{\circ}$ C. No. of	
				temperature cycle : 2	
13		Cable Aging test	IEC 60794-1-22,	Change in attenuation at 1550nm:	
			/ITU-T Rec. L.111	\leq 0.05dB, when cable is exposed	
				to 85 °C \pm 2 °C for a minimum of	
1.4			HTC (0000 1 0	168 hours.	
14	Safety Deceminant	Flame Spread-Single	IEC 60332-1-2	Char less than 0.54 m at completion	
	Kequirement	for single cable/Flame		ortest	
		retardant test single cable/			
		Flammability test single			
		cable			
		cable			

15		Smoke Test/Smoke density/Smoke density under fire conditions/Smoke density	IEC 61034-2	Minimum transmittance 60%			
16		Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables) /pH Test/pH & Conductivity/Conductivity Test/Degree of acidity	IEC 60754-2	pH not less than 4.3 Conductivity not more than 10 µS/mm			
17		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.			
18	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
19	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall subi type of Optical fibre used in	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
20	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
21	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable					
<i>LL</i>	Coloui	The manufacturer shall Sub		in compnance to ER of Optical FIDIE(ER	10. 100 /0112200/ 101 respective		

qualification for color fibres	type of Optical fibre used in the cable OR
	Test shall be carried as per IEC 60794-1-219

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	Standard Name	Limits/Values	Applicability
		Name		(as per ITU-T Rec.	
				L.110)	
1	Transmission Characteristics	Attenuation at 1310nm	IEC 60793-1-40	$\leq 0.36 \text{ dB/Km}$	Applicable to respective type of Optical fibre used in the cable as per ITU-T G.65x
2		Attenuation at 1550nm	IEC 60793-1-40	$\leq 0.22 \text{ dB/Km}$	Do
3		Attenuation at 1625nm	IEC 60793-1-40	\leq 0.25 dB/Km	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	$\leq 0.3 \text{ ps/}/\text{km}$	Do
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48	$\geq 0.3 \text{ ps/ vkm}$	D0
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at $1550 \text{ nm}: \le 0.05 \text{dB}$ & Fiber strain $\le 0.6\%$ when subjected to a Tensile load of 9.81 x 1 W Newton (where, W- mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550 nm: ≤ 0.05 dB when subjected to a compressive load of 2200N	
8		Impact	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Impact of 25Nm	3 Impact at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D	

				for 10 cycles.	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when cable is flexed with 1 cycle in 2sec to 5sec with Pulley diameter of	The bending rate shall be approximately one cycle in 2s to 5s and cable shall be free from any optical &
				20D (D- diameter of cable) and Load shall be as per FOTP 104. Total number of cycles be 25.	visual physical damage.
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Torsion with a load as per FOTP-85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.15 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: \leq 0.05dB, when cable is exposed to 85 °C ± 2 °C for a minimum of 168 hours.	
15		Water Blocking Test/Water	IEC 60794-1-22	Test duration: 24 Hours	No water shall be detected

		Penetration Test		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.	at the unsealed end of the sample. If a fluorescent dye is used, an ultraviolet light may be used for the examination.
16		Termite and Rodent Test	The manufacturer shall submit Undertaking that the Anti-termite/Anti- Rodent dopants used if any, are non-toxic and non-hazardous		
17		Electrical continuity test	IEC 60794-1-24/IEC 60794-1-403	The metallic elements shall be continuous.	Applicable for cable having Metallic Armoured/ metallic Strength element
18	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
19	Characteristics of Cable Elements	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
20	(Ribboned Fibre)	Separability of individual fibres from ribbon	IEC 60794-1-23	 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 	Applicable for Ribbon Fibre Only

				from each other.		
21		Ribbon Twist Test	Telecordia GR-20/ IEC 60794-1-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only	
22		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550 nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only	
23	Safety Requirements	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.		
24	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall submit N respective type of Optical fibre u	ITCTE Certificate in complused in the cable	iance to ER of Optical Fibre(ER No	o. TEC70112206) for	
25	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit N respective type of Optical fibre u	ITCTE Certificate in complused in the cable	iance to ER of Optical Fibre(ER No	o. TEC70112206) for	
26	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit N respective type of Optical fibre u	ITCTE Certificate in complused in the cable	iance to ER of Optical Fibre(ER N	o. TEC70112206) for	
27	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable				
28	Colour qualification for color fibres	The manufacturer shall submit respective type of Optical fibre u	MTCTE Certificate in con used in the cable	npliance to ER of Optical Fibre(ER No. TEC70112206) for	
		OR				
		Test shall be carried as per IEC ϵ	50794-1-219			

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

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

SN	Parameter Name	Individual Perometer Name	Standard Name	Limits/Values	Applicability
		Parameter Name		(as per 110-1 kec. L.109/ IEC 02807-5 (under study)	
1	Transmission Characteristics	Attenuation at 1310nm	IEC 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 1550nm	IEC 60793-1-40	$\leq 0.22 \text{ dB/Km}$	Do
3		Attenuation at 1625nm	IEC 60793-1-40	$\leq 0.25 \text{ dB/Km}$	Do
4		PMD Cabled Loose Fibre	IEC 60793-1-48	< 0.3 ps/\/km	
5		PMD Cabled Ribbon Fibre	IEC 60793-1-48		Do
6	Mechanical Characteristics	Tensile Strength	IEC 60794-1-21	Change in attenuation at 1550 nm ≤ 0.05 dB & Fiber strain $\leq 0.6\%$ when subjected to a Tensile load of 9.81 x 1 W Newton (where, W- mass of 1 Km of cable in Kg)	
7		Crush Resistance	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected compressive load of 2000N or as agreed by user	
8		Impact	IEC 60794-1-21	Change in attenuation when subjected to Impact load of 25Nm, at 1550nm: ≤ 0.05 dB.	3 impacts at 3 locations
9		Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05dB when subjected to Bend around a mandrel of diameter of 20D for 10 cycles	
10		Repeated Bend Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB	The bending rate

				when cable is flexed with 1 cycle in 2 sec to 5 sec with Pulley diameter of 20D (D- diameter of cable) and Load shall be as per FOTP 104 Total number of cycles be 25.	shall be approximately one cycle in 2s to 5s and cable shall be free from any optical & visual physical damage.
11		Torsion Test	IEC 60794-1-21	Change in attenuation at 1550nm: ≤ 0.05 dB when subjected to Torsion with a load as per FOTP-85A for 10 cycles.	Cable shall be free from any optical & visual physical damage.
12		Cable Drip Test	IEC 60794-1-22	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.
13	Environmental Characteristics	Temperature Cycling	IEC 60794-1-22	Change in attenuation at 1550nm: \leq 0.15 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	
14		Cable Aging test	IEC 60794-1-22	Change in attenuation at 1550nm: ≤ 0.05 dB, when cable is exposed to 85 °C \pm 2 °C for a minimum of 168 hours.	
15		Water Blocking Test/ Water Penetration Test	IEC 60794-1-22	Test duration: 24 hours 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.	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.
16		Lightning Test	110-1 Rec. L.109 FOTP-	The cable shall withstand the current level of	Applicable for

			181, ITU-T K-47	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.	Armoured cable.
17		Termite and Rodent Test	The manufacturer shall submit Undertaking that the Anti-termite/Anti-Rodent dopants used if any, are non-toxic and non- hazardous		
18		Electrical continuity test	IEC 60794-1-24/IEC 60794-1-403	The metallic elements shall be continuous.	Applicable for cable having Metallic Armoured/ metallic Strength element
19	Characteristics of Cable Elements (Buffer Tube)	Kink resistance Test	IEC 60794-1-23	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.
20	Characteristics of Cable Elements (Ribboned Fibre)	Ribbon Dimension	IEC 60794-1-23	As per IEC standard of different fibre count Ribbon	Applicable for Ribbon Fibre Only
21		Separability of individual fibres from ribbon	IEC 60794-1-23	 Breakout shall be accomplished without specialized tools or apparatus. The fibre breakout procedure shall not be 	Applicable for Ribbon Fibre Only
				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.	
22		Ribbon Twist Test	Telecordia GR-20/ IEC 60794-3-23	The ribbon shall not show any separation of individual fibres from the ribbon structure after completion of the twist test.	Applicable for Ribbon Fibre Only
23		Ribbon Torsion Resistance	IEC 60794-1-31	Change in attenuation at 1550nm: ≤ 0.05 dB	Applicable for Ribbon Fibre Only

24	Electrical	As per clause 6.1.2	IEC 60228	The cross-section of the metallic wire should	IEC 60228 for
	Characteristics –	of ITU-T L.109	IEC 60502-1	be designed according to the transmission	following Conductor
	Power Feeding		IEC 60227-1	voltage, transmission distance and the power	Strands/Class:
	Wires		IEC 61156-1	consumption.	• Class 1: Solid
			IEC 61196-1-10x		conductor
				Under extreme operating conditions, the heat	• Class 2: Stranded
			BS EN 50525	generated by conductors should not make the	conductor
			BS EN 60304	cable temperature exceed the maximum allowed	intended for fixed
				temperature in detailed specifications of the	installation
				cable element materials.	• Class 5: Flexible
					conductor
					• Class 6: Very
					Flexible conductor
					Conductor
					Size/Area
					(AWG/SQMM) to
					be decided on Power
					delivery over
					distances based on
					max allowable
					voltage drop
					The Insulated
					Copper Conductor
					Shall be meet the
					Electrical
					requirement of BS
					EN 50525
					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: 12, 24,48 & 57 V DC Low & Medium Power (15 W to 100 W) Distance support up to 1000 meter
25	Electromagnetic compatibility	Transfer impedance and Coupling attenuation	IEC 61156-1	Cable shall be electromagnetically complied.	
26	Safety Requirements	Flame Spread- Single cable	IEC/EN 60332-1-2	Char less than 0.54 m at completion of test	
27		Flame Spread- Bunched cable	IEC/EN 60332-3-24, Cat C	Char less than 2.5 m at completion of the test	
28		Smoke Test	IEC/EN 61034-2 ASTM D5424	Minimum transmittance 60%	ASTM D5424 for Smoke density
29		Acid gas (Toxicity) (Test on toxic gases evolved during combustion of materials from cables)	IEC/EN 60754-2		
30		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
31		The material used in the manufacturing of the OFC shall be non- toxic and dermatologically		The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of Optical fibre cable to substantiate the requirement.	

		safe in its life time and shall not be hazardous to health.
32	Geometrical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable
33	Transmission Characteristics of Fibre used in the Cable (Chromatic Dispersion)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable
34	Transmission Characteristics of Fibre used in the cable (Fibre Macro bend loss)	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable
35	Mechanical Characteristics of Fibre used in the cable	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable
36	Colour qualification for color fibres	The manufacturer shall submit MTCTE Certificate in compliance to ER of Optical Fibre(ER No. TEC70112206) for respective type of Optical fibre used in the cable OR Test shall be carried as per IEC 60794-1-219