Tender No.	:	Spec. No.	: WLS GS-23-OC 029 4-0 0
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Tender Title	:		
Bidder	: Wavenet, Inc.		
Document Title	:		

Specification

For

MICRO AIR BLOWN CABLE

(SZ Stranded Loose Tube Type)

Connecting the World

1. SCOPE

1.1 Application

This specification covers the general requirements of compact optical cables for air blowing installation conforming to ANSI/ICEA S-122-744. Mid-span express buffer tube storage is optional and only the cable with G.657.A2 is available with 8ft of maximum express tube storage.

1.2 Cable Description

Color coded fibers, gel filled color coded loose tubes, PE filler (if necessary), water swellable yarn, SZ-stranded around the dielectric central strength member, ripcords and outer PE jacket.

2. OPTICAL FIBER

The optical, geometrical, mechanical and environmental performance of the optical fiber shall be in accordance with Table 1 below.

Table 1. Performance of the Single Mode Fiber (ITU-T G.657A)

ITEMS		UNITS	SPECIFICATION	
			G.657A1	G.657A2
Attenuation at 1310/1383/1550nm		dB/km	≤ 0.36 / ≤ 0.35 / ≤ 0.22	
Chromatic Dispersion at 1285~1330/1550 nm		ps/nm.km	≤ 3.5 / ≤ 18	
Zero Dispersion Wavelength		nm	1300 ~ 1324	
Zero Dispersion Slope		ps/nm2.km	≤ 0.092	
Cable PMD (PMDQ)		ps/√km	≤ 0.2 (20 section link)	
Cut-off wavelength (λcc)		nm	≤ 1260	
Attenuation vs Bending at 1550/1625nm	R15mm x 10	dB	≤ 0.25 / ≤ 1.0	≤ 0.03 / ≤ 0.1
	R10mm x 1	dB	≤ 0.75 / ≤ 1.5	≤ 0.1 / ≤ 0.2
	R7.5mm x 1	dB	-	≤ 0.5 / ≤ 1.0
MFD at 1310nm		μm	8.9 ± 0.4	8.6 ± 0.4
Core/Cladding Concentricity Error		μm	≤ 0.5	
Cladding Diameter		μm	125 ± 0.7	
Cladding Non-circularity		%	≤ 1.0	
Coating Diameter		μm	245 ± 10	
Proof Test		GPa	≥ 0.69	

3. CABLE CONSTRUCTION

The construction of the cable shall be in accordance with Table 2 below.

Table 2. Construction of the Cable

ITEMS	DESCRIPTION			
Number of Fibers	12 ~ 72	96	144	288
No. of Fibers per Tube	12	12	12	12
No. of Gel-Filled Loose Buffer Tube	Max. 6	8	12	9+15
No. of PE Filler	Max. 5	-	-	-
Central Strength Member	FRP (with PE coating if necessary)			
Water Blocking Material	Water Swellable Yarn/Binder			
Rip Cord	Two Aramid Yarn			
Outer Jacket	Black HDPE			
Cable Diameter (± 0.2mm)	5.8	6.5	8.1	10.2
Approx. Cable Weight (kg/km)	28	38	60	83

4. FIBER AND LOOSE BUFFER TUBE IDENTIFICATION

The color code of the loose buffer tubes and the individual fibers within each loose buffer tube shall be in accordance with Table 3 to Table 4 below.

Table 3. The Color Code of the Individual Fibers

No.	Color	No.	Color	No.	Color
1	Blue	5	Slate	9	Yellow
2	Orange	6	White	10	Violet
3	Green	7	Red	11	Rose
4	Brown	8	Black	12	Aqua

Table 4. The Color Code of the Loose Buffer Tubes

No.	Color	No.	Color	No.	Color
1	Blue	9	Yellow	17	Slate / BK Stripe
2	Orange	10	Violet	18	White / BK Stripe
3	Green	11	Rose	19	Red / BK Stripe
4	Brown	12	Aqua	20	Black / WH Stripe
5	Slate	13	Blue / BK Stripe	21	Yellow / BK Stripe
6	White	14	Orange / BK Stripe	22	Violet / BK Stripe
7	Red	15	Green / BK Stripe	23	Rose / BK Stripe
8	Black	16	Brown / BK Stripe	24	Aqua / BK Stripe

5. PHYSICAL / MECHANICAL / ENVIRONMENTAL PERFORMANCE AND TESTS

5.1 Temperature Range

For the cables covered by this specification, the following temperature ranges apply:

- Operation : -30 °C to +70°C (-22°F to +158°F)
- Installation : -10 °C to +60°C (+14°F to +140°F)
- Storage/Shipping : -30 °C to +70°C (-22°F to +158°F)

5.2 Mechanical and Environmental Performance of the Cable

The mechanical and environmental performance of the cable shall be in accordance with Table 5 below. Unless otherwise specified, all attenuation measurements required in this section shall be performed at 1550nm for Single Mode Fibers.

Table 5. The Mechanical and Environmental Performance of the Cable

ITEMS	TEST METHOD AND REQUIREMENTS
Tensile Loading And Bending Test	▪ Test method : TIA/EIA-455-33B - Mandrel diameter : Min. 40D (D: cable diameter) - Installation tensile load : 1 X W (W: cable weight in kg/km) for 1hour - Residual tensile load : 30% of installation tensile load for 10minutes ▪ Acceptance criteria - Fiber strain : ≤ 0.60% during the installation tensile load ≤ 0.20% during the residual tensile load - Attenuation increment: ≤ 0.15 dB for residual tensile load
Compressive Loading Resistance Test	▪ Test method : TIA/EIA-455-41A - Load : 500N/10cm - Duration of load : 1 minute - Test numbers : 1 time ▪ Acceptance criteria - Attenuation increment: ≤ 0.15 dB before release of the load - No damage to the sheath and to the cable elements
Impact Test	▪ Test method : TIA/EIA-455-25D - Impact energy : 1J (e.g. 150mm X 0.7kg) - No. of impact : one at three different places (Min. 150mm apart) ▪ Acceptance criteria - Attenuation increment: ≤ 0.15 dB after the test - No damage to the sheath and to the cable elements
Cyclic Flexing Test	▪ Test method : TIA/EIA-455-104A - Bending diameter : 40D or 300mm - No. of cycles : 25 - Flexing speed : 30 cycles/minute ▪ Acceptance criteria - Attenuation increment: ≤ 0.15 dB after the test - No damage to the sheath and to the cable elements

ITEMS	TEST METHOD AND REQUIREMENTS
Torsion	▪ Test method: TIA/EIA-455-85A - Length under test : 2m - No. of cycles: 10 cycles - Test speed : Max. 1min/cycle - Rotating angle : ±180° ▪ Acceptance criteria - Attenuation increment: ≤ 0.15 dB after the test - No damage to the sheath and to the cable elements
Kink	▪ Test method: IEC 60794-1-21 Method E10 - Minimum diameter : 40D ▪ Acceptance criteria - No damage to the sheath and to the cable elements
Temperature Cycling	▪ Test method: TIA/EIA-455-3B - Temperature condition: 23°C → -30°C → 70°C→ -30°C → 70°C→ 23°C - Soak time at each temperature : ≥12 hours - Attenuation shall be measured at 23°C (reference attenuation) before the sequence and at the end of the soak time at each step in the 2nd cycle ▪ Acceptance criteria - Attenuation increment: ≤0.15 dB/km
Water Penetration Test	▪ Test method: TIA/EIA-455-82C - Length of specimen: 3m - Height of pressure head: 1m - Test time: 24 hours ▪ Acceptance criteria - No water shall be detected at the unsealed end of the sample

6. PACKING AND MARKING

6.1 Cable Marking

The jacket shall be marked with white characters at intervals of two feet(or one meter) with following information. Other marking is also available if requested by customer.

1) Cable type and fiber number
2) Name of the manufacturer
3) Year of manufacture
4) Length marking

6.2 Cable Packing

6.2.1 Standard length of cable shall be 2,000 or 4,000 meters. Other cable length is also available if required by customer.

6.2.2 Each length of the cable shall be wound on a separate wooden reel.

6.2.3 Both ends of the cable shall be sealed with a suitable plastic cap to prevent the entry of moisture during shipping, handling and storage.

6.2.4 The cable ends shall be securely fastened to the reel to prevent the cable form becoming loose in transit or during placing operations.

6.2.5 The inner end of the cable is housed into a slot on the side of the reel without extra cable length for testing.

6.2.6 Circumference battens or Wood-fiber board shall be secured with suitable bands to protect the cable during normal handling and shipping.

6.3 Cable Reel

6.3.1 Details given below shall be distinctly marked with a weather proof material on the both outer sides of the reel flange. Other shipping mark is also available if requested by customer.

1) Purchaser's name
2) Length of cable in meter
3) Number of fibers and size
4) Gross weight in kilogram
5) Reel number
6) Name of the manufacturer
7) Year of manufacture
8) Arrow showing the direction the drum shall be rolled

6.3.2 The cable shall be shipped on reels designed to prevent damage to the cable during shipment and installation.

7. HEALTH, SAFETY AND ENVIRONMENT

7.1 ROHS DIRECTIVE

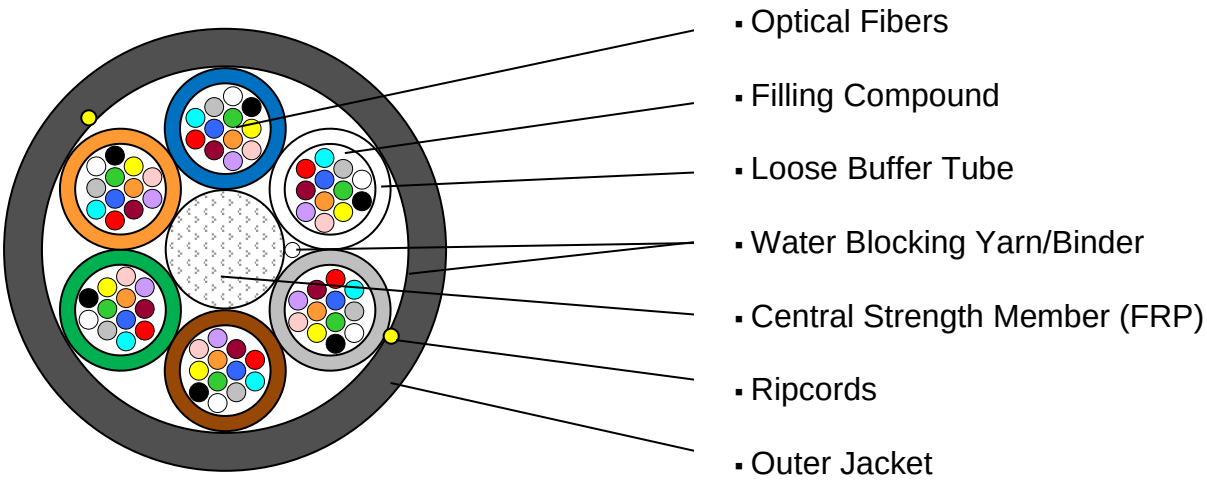
All cables and any associated packing and labeling materials shall meet RoHS (Restriction of the Use of certain Hazardous Substances) regulations as appropriate.

7.2 ISPM 15

All wooden packing materials shall meet ISPM (International Standards for Phytosanitary Measures) regulations as appropriate.

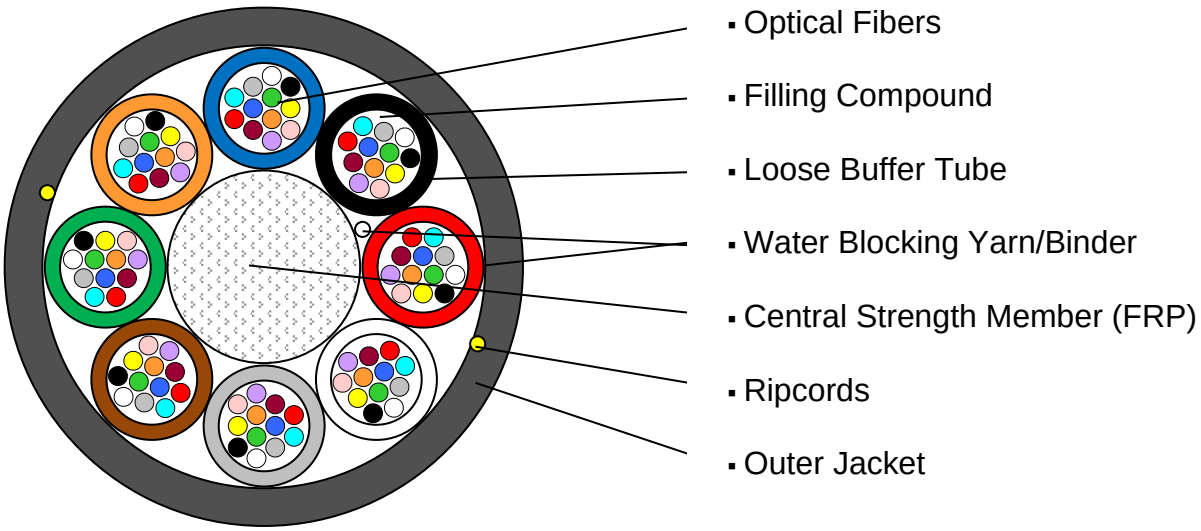
Appendix 1. Cross-sectional Drawing of the Cable

1. 12~72-Fibers (12F/Tube)
   (For 12-60F Cable, Fillers shall be applied instead of loose buffer tubes.)



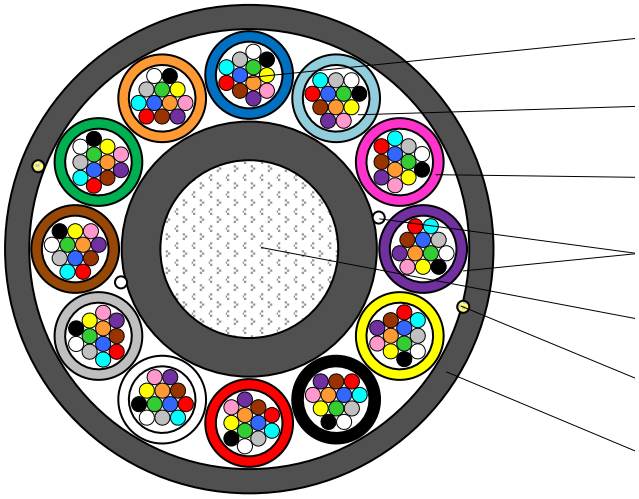
- Not to scale -

2. 96-Fibers (12F/Tube)



- Not to scale -

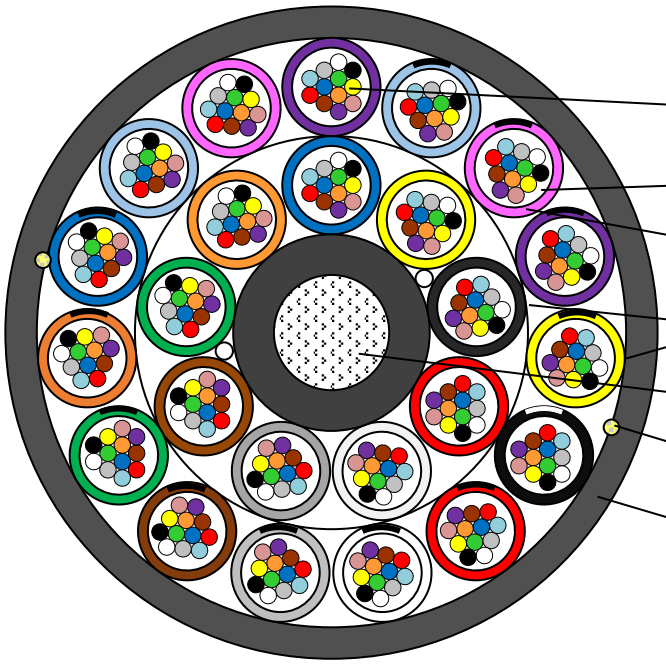
3. 144-Fibers (12F/Tube)



- Optical Fibers
- Filling Compound
- Loose Buffer Tube
- Water Blocking Yarn/Binder
- Central Strength Member (FRP)
- Ripcords
- Outer Jacket

- Not to scale -

4. 288-Fibers (12F/Tube)



- Optical Fibers
- Filling Compound
- Loose Buffer Tube
- Water Blocking Yarn/Binder
- Central Strength Member (FRP)
- Ripcords
- Outer Jacket

- Not to scale -

== End of Specification ==