

LL (Low Loss) Coaxial Cable

-solid center conductors



Construction:

Center Conductor: Solid silver plated copper

Dielectric: Expanded PTFE tape

Inner Braid: Flat silver plated copper strip

Interlayer: Aluminum polyester or polyimide tape

Outer Braid: Round silver plated copper

Jacket: FEP, translucent colors, solid colors or clear

Operating temperature -55 +200° C

Velocity of Propagation 80%-83%

Impedance 50 Ohms

Capacitance 25.0 pF/ft

Shielding Effectiveness <-95 dB

	LL142	LL235	LL335	LL335i
Center conductor diameter	.051"	.057"	.089"	.089"
Dielectric diameter	.145"	.165"	.250"	.250"
Diameter over inner braid	.152"	.170"	.255"	.255"
Diameter over interlayer	.158"	.175"	.261"	.261"
Diameter over outer braid	.178"	.191"	.280"	.277"
Overall diameter	.195"	.229"	.332"	.300"
Weight(lbs/mft)	44	52	100	76
Bend radius	1.0"	1.2"	1.7"	1.5"
Attenuation (dB/100ft) @	Typ	Typ	Typ	Typ
400 MHz	4.7	4.2	2.9	2.9
1 GHz	7.5	6.7	4.6	4.6
2 GHz	10.7	9.6	6.6	6.6
3 GHz	13.2	11.9	8.2	8.2
5 GHz	17.2	15.5	10.8	10.8
10 GHz	24.9	22.5	15.8	15.8
18 GHz	34.2	31.0	21.9	21.9

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Unique cable design

The braid configuration and the expanded PTFE dielectrics of the LL cable constructions contribute to lower attenuation levels at higher frequencies, while providing shielding effectiveness levels that exceed those of flexible MIL-DTL-17 cables. Flat strips of silver plated copper are braided over the dielectric core with an intermediate metallized polyester or polyimide layer, and an outer round wire braid.

Excellent electrical characteristics

All of Harbour's LL cables with expanded PTFE dielectrics exhibit low coefficients of expansion over the entire operating temperature range from -55° C to +200° C. Impedance discontinuities are minimized at the cable-to-connector interface. Higher levels of power can be transmitted because higher temperatures do not affect the cable due to the thermal stability of the tape. Where phase versus temperature requirements are critical, Harbour's LL cables allow for an approximately 75% lower phase shift and change in propagation time delay due to temperature. Temperature cycling tests have been performed on a number of Harbour's cables with positive results.

Lowest attenuation for any given size

Harbour's LL coaxial cables, with expanded PTFE dielectrics and strip braid composite configurations, offer attenuation from 20 to 35% below other mil spec cables of comparable size. When size and weight are considerations, Harbour's LL cables should be specified.

Attenuation Calculation and K Factors

Although typical and maximum attenuation values are given for discrete frequencies, typical attenuation values may be calculated by using K1 and K2 factors for each construction. The K1 factor is calculated by taking into consideration the type, strand factor, and diameter of the center conductor, and the impedance of the cable. The K2 factor is calculated by taking into consideration the velocity of propagation and the dissipation factor of the dielectric.

Formula for Calculating Attenuation using K Factors:

$$\text{Attenuation (dB/100 ft) at any frequency (MHz)} = (K1 \times \sqrt{\text{frequency}}) + (K2 \times \text{frequency})$$

	LL142	LL235	LL335/LL335i
K1	.231	.207	.141
K2	.0001785	.0001785	.0001674

LL (Low Loss) Coaxial Cable

-stranded center conductors



Construction:

Center Conductor: Stranded silver plated copper

Dielectric: Expanded PTFE tape

Inner Braid: Flat silver plated copper strip

Interlayer: Aluminum polyester or polyimide tape

Outer Braid: Round silver plated copper

Jacket: FEP, translucent colors, solid colors or clear

Operating temperature -55 +200° C

Velocity of Propagation 80%-83%

Impedance 50 Ohms

Capacitance 25.0 pF/ft

Shielding Effectiveness <-95 dB

	LL142STR	LL270STR	LL450STR	LL480STR
Center conductor diameter	.051" (7/.017")	.068" (7/.023")	.133" (7/.048")	.160" (7/.054")
Dielectric diameter	.138"	.185"	.360"	.420"
Diameter over inner braid	.146"	.195"	.368"	.432"
Diameter over interlayer	.152"	.200"	.374"	--
Diameter over outer braid	.168"	.220"	.394"	.452"
Overall diameter	.195"	.270"	.450"	.480"
Weight(lbs/mft)	42	70	175	184
Bend radius	1.0"	1.4"	2.5"	2.75"
Attenuation (dB/100ft) @	Typ	Typ	Typ	Typ
400 MHz	6.0	4.2	2.3	1.9
1 GHz	9.5	6.6	3.7	3.1
2 GHz	13.5	9.5	5.3	4.5
3 GHz	16.6	11.7	6.6	5.6
5 GHz	21.7	15.2	8.7	7.5
10 GHz	31.2	22.0	12.8	11.2
18 GHz	42.7	30.1	-	-

See HF Low Loss Coax product pages for LL160-40GHz and LL142-26GHz cables with guaranteed attenuation and VSWR performance at frequencies above 18GHz.

LL (Low Loss) Coaxial Cable

-stranded center conductors

Flexibility with stranded center conductors

Harbour's Low Loss coax designs with stranded center conductors are more flexible than similar designs with solid center conductors. Low loss cables with stranded center conductors exhibit attenuation slightly higher than comparable solid center conductor designs; however, unique composite braid configurations and expanded PTFE dielectrics result in attenuation lower than MIL-DTL-17 cables of comparable size. Shielding effectiveness levels also exceed those of flexible MIL-DTL-17 constructions.

Excellent electrical characteristics

All of Harbour's LL cables with expanded PTFE dielectrics exhibit low coefficients of expansion over the entire operating temperature range from -55° C to +200° C. Impedance discontinuities are minimized at the cable-to-connector interface. Higher levels of power can be transmitted because higher temperatures do not affect the cable due to the thermal stability of the tape. Where phase versus temperature requirements are critical, Harbour's LL cables allow for an approximately 75% lower phase shift and change in propagation time delay due to temperature. Temperature cycling tests have been performed on a number of Harbour's cables with positive results.

Attenuation Calculation and K Factors

Although typical and maximum attenuation values are given for discrete frequencies, typical attenuation values may be calculated by using K1 and K2 factors for each construction. The K1 factor is calculated by taking into consideration the type, strand factor, and diameter of the center conductor, and the impedance of the cable. The K2 factor is calculated by taking into consideration the velocity of propagation and the dissipation factor of the dielectric.

Formula for Calculating Attenuation using K Factors:

$$\text{Attenuation (dB/100 ft) at any frequency (MHz)} = (\text{K1} \times \sqrt{\text{frequency}}) + (\text{K2} \times \text{frequency})$$

	LL142STR	LL270STR	LL450STR	LL480STR
K1	.294	.204	.112	.091
K2	.0001785	.000143	.00016	.00021