

# Rail & Transit Solutions

**Times LMR<sup>®</sup>**  
Coaxial Cable & Connectors

**Times  Protect<sup>®</sup>**  
RF Lightning Protection



# Introduction

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# Capability/Application

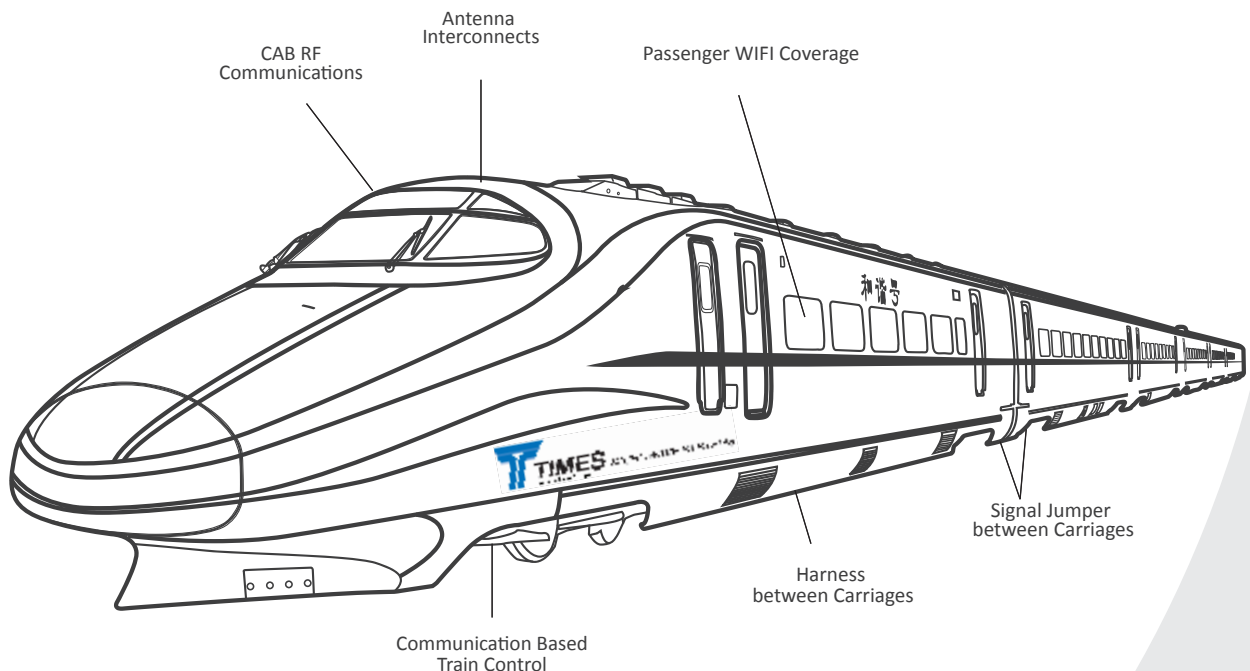
Times Microwave Systems (TMS) – recognized as the global leader in coaxial transmission line technology, has been at the forefront of providing solutions for military, aerospace, wireless communications & industrial applications for the past 60 years.

TMS has consistently developed new products, innovations and qualifications across the Rail & Transit markets, whilst having by far the most comprehensive range of cable / connector products in the industry. TMS cables are designed to be ultra-flexible, smaller, lightweight, high performance products in order to maintain signal integrity, whilst ensuring high electrical stability and mechanical robustness in the most challenging of transit environments.

With the rapid forecasted growth in the rail transit industry, production levels are expected to increase significantly. TMS, as an existing qualified manufacturer with rich application experience, are an excellent partner for you. We can engineer customized solutions to meet your unique requirements in product design, installation, commissioning, performance improvement and regulatory requirements.

## Typical Applications:

- Positive Train Control PTCS – command, control, communications, signaling, information
- Locomotives, Light rail, Metro, Subway, Buses
- Location – GPS, Satcom
- Emergency Services – TETRA +
- CCTV & concealed CCTV both for rolling stock and trackside
- Wifi for rolling stock and trackside
- Automatic door opening systems



# Qualification

**IEC 60332:** Tests on electric and optical fiber cables under fire conditions

**IEC 61034:** Measurement of smoke density of cables burning under defined conditions

**IEC 60754:** Test on gases evolved during combustion of materials from cables

**BS 6853:** Code of practice for fire precautions in the design and construction of passenger carrying trains

**DIN 5510-2:** Preventive fire protection in railway vehicles; Part 2: Fire behavior and fire side effects of materials and parts, classification, requirement and test methods

**EN 45545:** Railway applications- Fire protection of railway vehicles-Part 2: Requirement for fire behavior of materials and components

**NFIA-130:** Standard for fixed wideway transit and passenger rail

**UL:** Underwriters Laboratories Type “CMR” approved for Riser applications



# Qualification

## Qualification Standard for TMS products for Railway Applications

Flame Item	Description	IEC Standard	BS Standard	DIN Standard	EN Standard	NF Standard
Flammability	Vertical flaming test of the fire behavior on a single core or a single cable	IEC 60332-1-2	BS6853 (BS4066-1)	DIN 5510-2	EN 45545-2	-
	Vertical flaming test of the fire behavior on bunched cables	IEC 60332-3	BS6853 (BS4066-3)	DIN 5510-2	EN 45545-2	-
Smoke Density	Measurement of smoke density of cables burning under defined conditions	IEC 61034-2	BS6853	-	EN 45545-2	-
Halogen acid gas	Test on gases evolved during combustion of materials from cables, determination of the amount of halogen acid gas	IEC 60754-1	BS 6425-1	-	EN 50267-2-1	-
Gas analysis	Methods for analyzing gases produced by thermal degradation.	-	BS6853	-	EN 45545-2	NFX70-100-1
	Tubular furnace thermal degradation method	-	BS6853	-	EN 45545-2	NFX70-100-2

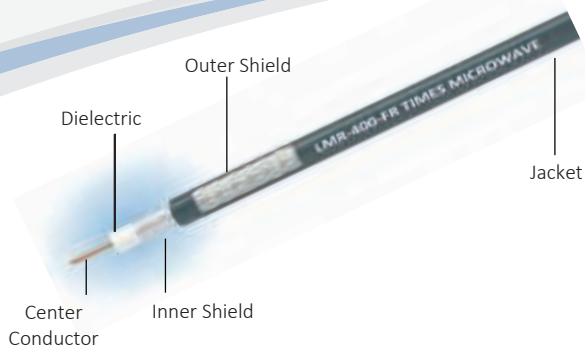
Times LMR-FR series cables are both UL and CSA listed (CMR/CATVR) per UL File # E-170516, and also meet fire resistance standard of IEC60332-1-2, IEC60332-3, IEC61034-2, IEC60754-1, NFX70-100-1/2.



# LMR<sup>®</sup>-FR

LMR<sup>®</sup>-FR is non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building and rail/transit applications.

LMR<sup>®</sup>-FR is UL/NEC & CSA rated “CMR” and “FT4” respectively, and listed under UL File E-170516.



## Features:

- Excellent flexibility and bendability
- Much lower loss than any flexible cable
- Superior RF Shielding effectiveness
- Available as fully tested, custom cable assemblies
- Excellent temperature performance (-40°C to +85°C)

## Construction:

- Center Conductor: Solid BC (195/240/300)  
Solid BCCAI (400/500/600)
- Dielectric: Foam PE
- Inner Shield: Bonded Aluminum Tape
- Outer Shield: Tinned Copper Braid
- Jacket: FRPE

## Specifications:

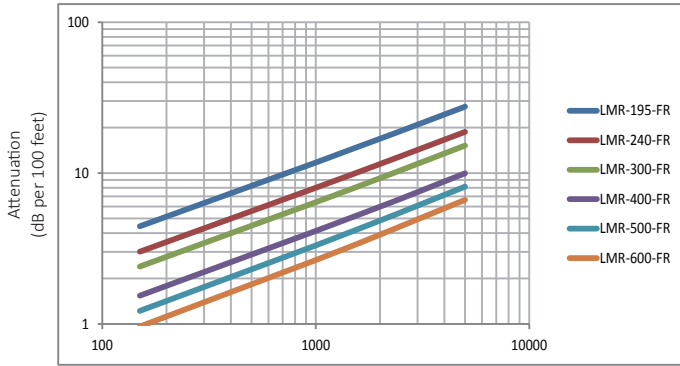
	LMR-195-FR	LMR-240-FR	LMR-300-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR
AA Number	8601	8894	8604	8120	8121	8122
Stock Code	54111	54029	54087	54030	54031	54032
Physical Specifications						
Description	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Inner Conductor	0.037 (0.94)	0.056 (1.42)	0.070 (1.78)	0.108 (2.74)	0.142 (3.61)	0.176 (4.47)
Dielectric	0.110 (2.79)	0.150 (3.81)	0.190 (4.83)	0.285 (7.24)	0.370 (9.40)	0.455 (11.56)
Inner Shield	0.116 (2.95)	0.155 (3.94)	0.196 (4.98)	0.291 (7.39)	0.376 (9.55)	0.461 (11.71)
Outer Shield	0.139 (3.53)	0.178 (4.52)	0.225 (5.72)	0.320 (8.13)	0.405 (10.29)	0.490 (12.45)
Jacket	0.195 (4.95)	0.240 (6.10)	0.300 (7.62)	0.405 (10.29)	0.500 (12.70)	0.590 (14.99)

	LMR-195-FR	LMR-240-FR	LMR-300-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR
Mechanical & Environmental Specifications						
Bend Radius: installation	0.50 (12.7)	0.75 (19.1)	0.88 (22.2)	1.00 (25.4)	1.25 (31.8)	1.50 (38.1)
Weight / lb/ft (kg/m)	0.021 (0.03)	0.034 (0.05)	0.055 (0.08)	0.068 (0.10)	0.097 (0.14)	0.131 (0.20)
Operating Temperature Range	-40°F / +185°F (-40°C / +85°C)					

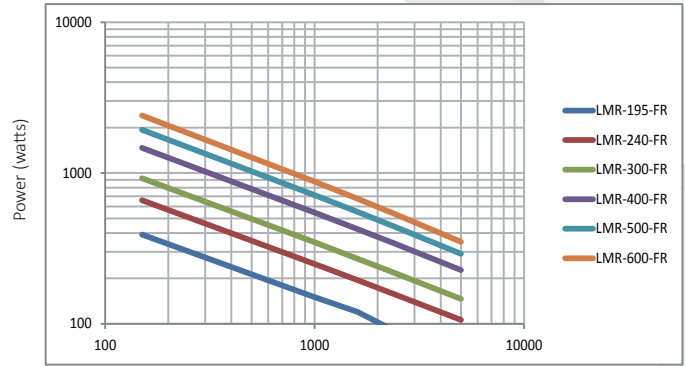
	LMR-195-FR	LMR-240-FR	LMR-300-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR
Electrical Specifications						
Velocity of Propagation	80%	83%	82%	84%	82%	85%
Time Delay / nS/ft (nS/m)	1.27 (4.17)	1.21 (3.97)	1.20 (3.92)	1.20 (3.92)	1.18 (3.88)	1.17 (3.83)
Impedance / ohms	50	50	50	50	50	50
Capacitance / pF/ft (pF/m)	25.4 (83.3)	24.2 (79.4)	23.9 (78.4)	23.9 (78.4)	23.6 (77.5)	23.4 (76.6)
Shielding Effectiveness / dB	90	90	90	90	90	90

# LMR<sup>®</sup>-FR

Attenuation vs. Frequency (Typical)



Power Handling vs. Frequency (Maximum)

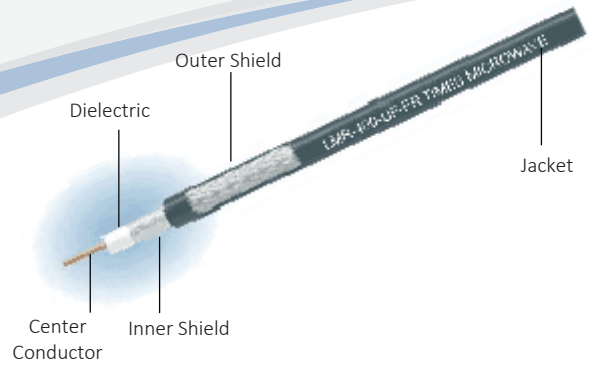


	LMR-195-FR	LMR-240-FR	LMR-300-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR
<b>Attenuation: dB/100ft (100m) (+25°C Ambient)</b>						
150 MHz	4.4 (14.6)	3.0 (9.9)	2.4 (7.9)	1.5 (5.0)	1.2 (4.0)	1.0 (3.2)
450 MHz	7.8 (25.5)	5.3 (17.3)	4.2 (13.8)	2.7 (8.9)	2.2 (7.1)	1.7 (5.6)
900 MHz	11.1 (36.5)	7.6 (24.8)	6.1 (19.9)	3.9 (12.8)	3.1 (10.3)	2.5 (8.2)
1500 MHz	14.5 (47.7)	9.9 (32.4)	7.9 (26.0)	5.1 (16.8)	4.1 (13.6)	3.3 (10.9)
2000 MHz	16.9 (55.4)	11.5 (37.7)	9.2 (30.3)	6.0 (19.6)	4.8 (15.9)	3.9 (12.8)
2500 MHz	19.0 (62.4)	12.9 (42.4)	10.4 (34.2)	6.8 (22.2)	5.5 (18.0)	4.4 (14.5)
5800 MHz	29.9 (98.1)	20.4 (66.8)	16.5 (54.2)	10.8 (35.5)	8.9 (29.1)	7.3 (23.8)
8000 MHz	35.7 (117.1)	24.3 (79.7)	19.8 (65.0)	13.0 (42.7)	10.7 (35.2)	8.8 (29.0)

	LMR-195-FR	LMR-240-FR	LMR-300-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR
<b>Average Power: Watts (+40°C Ambient; Sea Level)</b>						
150MHz	390	660	920	1470	1931	2410
450 MHz	220	380	520	830	1088	1350
900 MHz	160	260	360	580	752	930
1500 MHz	120	200	280	440	569	700
2000 MHz	100	170	240	370	485	590
2500 MHz	90	150	210	330	428	520
5800 MHz	60	100	130	210	264	320
8000 MHz	40	80	110	170	220	260

# LMR<sup>®</sup>-UF-FR

LMR<sup>®</sup>-UF-FR has a stranded center conductor, it is non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building and rail/transit applications.



## Features:

- Excellent flexibility and bendability, tightest bend radius
- Much lower loss than any flexible cable
- Superior RF Shielding effectiveness
- Available as fully tested, custom cable assemblies
- non-halogen (non-toxic), low smoke, fire retardant
- Excellent temperature performance (-40°C to +85°C)

## Construction:

Center Conductor: Stranded BC  
 Dielectric: Foam PE  
 Inner Shield: Bonded Aluminum Tape  
 Outer Shield: Tinned Copper Braid  
 Jacket: FRPE

## Specifications:

	LMR-195-UF-FR	LMR-240-UF-FR	LMR-400-UF-FR	LMR-500-UF-FR	LMR-600-UF-FR
AA Number	11426	9590	9614	11906	9865
Stock Code	54360	54143	54270	54414	54310
Physical Specifications					
Description	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Inner Conductor	0.038 (0.97)	0.056 (1.42)	0.108 (2.74)	0.142 (3.61)	0.176 (4.47)
Dielectric	0.110 (2.79)	0.150 (3.81)	0.285 (7.24)	0.370 (9.40)	0.455 (11.56)
Inner Shield	0.116 (2.95)	0.155 (3.94)	0.291 (7.39)	0.376 (9.55)	0.461 (11.71)
Outer Shield	0.139 (3.53)	0.178 (4.52)	0.320 (8.13)	0.405 (10.29)	0.490 (12.45)
Jacket	0.195 (4.95)	0.240 (6.10)	0.405 (10.29)	0.500 (12.70)	0.590 (14.99)

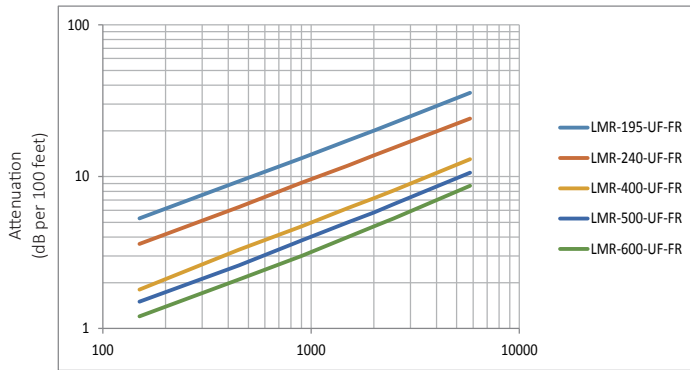
	LMR-195-UF-FR	LMR-240-UF-FR	LMR-400-UF-FR	LMR-500-UF-FR	LMR-600-UF-FR
Mechanical & Environmental Specifications					
Bend Radius: installation	0.50 (12.7)	0.75 (19.1)	1.00 (25.4)	1.25 (31.8)	1.50 (38.1)
Weight / lb/ft (kg/m)	0.021 (0.03)	0.034 (0.05)	0.088 (0.131)	0.100 (0.15)	0.165 (0.25)
Operating Temperature Range	-40°F / +185°F (-40°C / +85°C)				

	LMR-195-UF-FR	LMR-240-UF-FR	LMR-400-UF-FR	LMR-500-UF-FR	LMR-600-UF-FR
Electrical Specifications					
Velocity of Propagation	74%	80%	83%	85%	87%
Time Delay / nS/ft (nS/m)	1.27 (4.17)	1.21 (3.97)	1.20 (3.92)	1.20 (3.92)	1.17 (3.83)
Impedance / ohms	50	50	50	50	50
Capacitance / pF/ft (pF/m)	25.4 (83.3)	24.2 (79.4)	23.9 (78.4)	23.9 (78.4)	23.4 (76.6)
Shielding Effectiveness / dB	90	90	90	90	90

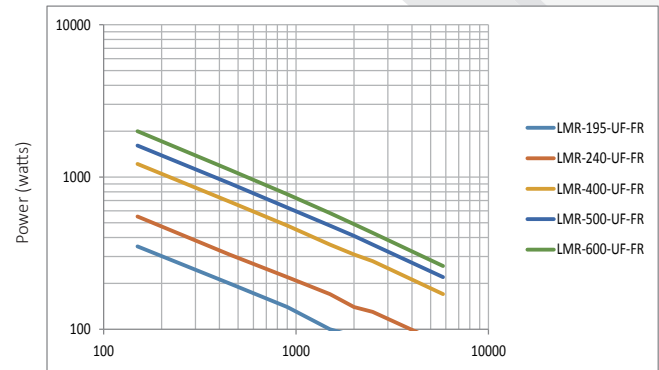


# LMR<sup>®</sup>-UF-FR

Attenuation vs. Frequency (Typical)



Power Handling vs. Frequency (Maximum)

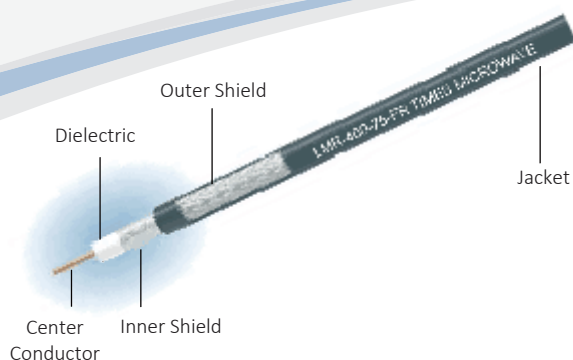


	LMR-195-UF-FR	LMR-240-UF-FR	LMR-400-UF-FR	LMR-500-UF-FR	LMR-600-UF-FR
<b>Attenuation: dB/100ft (100m) (+25°C Ambient)</b>					
150 MHz	5.3 (17.3)	3.6 (11.9)	1.8 (6.1)	1.5 (4.8)	1.2 (3.8)
450 MHz	9.3 (30.4)	6.3 (20.8)	3.3 (10.7)	2.6 (8.5)	2.1 (6.8)
900 MHz	13.2 (43.4)	9.1 (29.8)	4.7 (15.4)	3.8 (12.3)	3.0 (9.8)
1500 MHz	17.3 (56.8)	11.8 (38.9)	6.2 (20.2)	5.0 (16.3)	4.0 (13.1)
2000 MHz	20.1 (65.9)	13.8 (45.2)	7.2 (23.6)	5.8 (19.1)	4.7 (15.3)
2500 MHz	22.6 (74.2)	15.5 (50.9)	8.1 (26.6)	6.6 (21.6)	5.3 (17.4)
5800 MHz	35.6 (116.7)	24.1 (80.1)	13.0 (42.6)	10.6 (34.9)	8.7 (28.6)

	LMR-195-UF-FR	LMR-240-UF-FR	LMR-400-UF-FR	LMR-500-UF-FR	LMR-600-UF-FR
<b>Average Power: Watts (+40°C Ambient; Sea Level)</b>					
150 MHz	350	550	1220	1610	2000
450 MHz	200	310	690	910	1120
900 MHz	140	220	480	630	770
1500 MHz	100	170	360	480	580
2000 MHz	90	140	310	410	490
2500 MHz	80	130	280	360	430
5800 MHz	50	80	170	220	260

# LMR<sup>®</sup>-75-FR

LMR<sup>®</sup>-75-FR cable is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any smooth wall or corrugated hard-line cables.



## Features:

- Excellent flexibility and bendability
- Much lower loss than any flexible cable
- Superior RF Shielding effectiveness
- UV Resistance
- Excellent temperature performance (-40°C to +85°C)

## Construction:

Center Conductor: Solid BC (200/240/300/400)  
Solid BCCAI (600)

Dielectric: Foam PE

Inner Shield: Bonded Aluminum Tape

Outer Shield: Tinned Copper Braid

Jacket: Black FRPE

## Specifications:

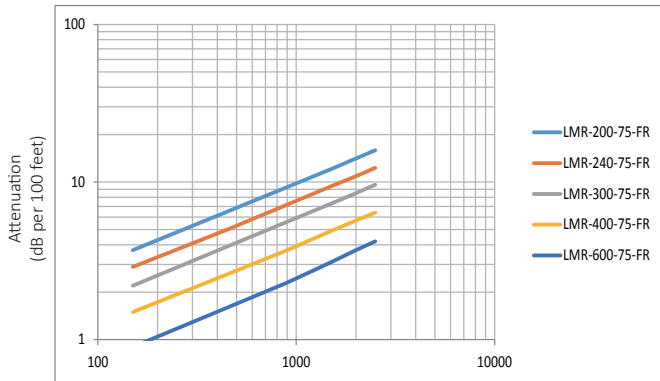
	LMR-200-75-FR	LMR-240-75-FR	LMR-300-75-FR	LMR-400-75-FR	LMR-600-75-FR
AA Number	60057	60058	60059	9540	9650
Stock Code	54252	54259	54251	54256	54258
<b>Physical Specifications</b>					
Description	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Inner Conductor	0.025 (0.64)	0.032 (0.82)	0.044(1.12)	0.065 (1.65)	0.108 (2.74)
Dielectric	0.116 (2.95)	0.150 (3.81)	0.190 (4.83)	0.285 (7.24)	0.455 (11.56)
Inner Shield	0.121 (3.07)	0.155 (3.94)	0.196 (4.98)	0.291 (7.39)	0.461 (11.71)
Outer Shield	0.144 (3.66)	0.178 (4.52)	0.225 (5.72)	0.320 (8.13)	0.490 (12.45)
Jacket	0.195 (4.95)	0.240 (6.10)	0.300 (7.62)	0.405 (10.29)	0.590 (14.99)

	LMR-200-75-FR	LMR-240-75-FR	LMR-300-75-FR	LMR-400-75-FR	LMR-600-75-FR
<b>Mechanical &amp; Environmental Specifications</b>					
Bend Radius: installation	0.50 (12.7)	0.75 (19.1)	0.875 (22.2)	1.00 (25.4)	1.50 (38.1)
Weight / lb/ft (kg/m)	0.022 (0.03)	0.034 (0.05)	0.055 (0.08)	0.068 (0.10)	0.131(0.20)
Operating Temperature Range	-40°F / +185°F (-40°C / +85°C)				

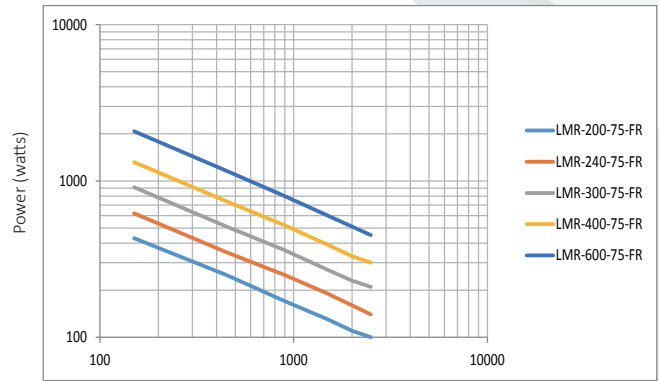
	LMR-200-75-FR	LMR-240-75-FR	LMR-300-75-FR	LMR-400-75-FR	LMR-600-75-FR
<b>Electrical Specifications</b>					
Velocity of Propagation	83%	84%	85%	85%	87%
Time Delay / nS/ft (nS/m)	1.22 (4.02)	1.21 (3.97)	1.20 (3.92)	1.20 (3.92)	1.17 (3.83)
Impedance / ohms	75	75	75	75	75
Capacitance / pF/ft (pF/m)	16.3 (53.6)	16.1 (52.9)	15.9 (52.3)	15.9 (52.3)	15.6 (51.1)
Shielding Effectiveness / dB	90	90	90	90	90

# LMR<sup>®</sup>-75-FR

Attenuation vs. Frequency (Typical)



Power Handling vs. Frequency (Maximum)



	LMR-200-75-FR	LMR-240-75-FR	LMR-300-75-FR	LMR-400-75-FR	LMR-600-75-FR
<b>Attenuation: dB/100ft (100m) (+25°C Ambient)</b>					
150 MHz	3.7 (12.2)	2.9 (9.4)	2.2 (7.2)	1.5 (4.8)	0.9 (3.0)
450 MHz	6.5 (21.4)	5.0 (16.4)	3.9 (12.7)	2.6 (8.4)	1.6 (5.3)
900 MHz	9.3 (30.6)	7.2 (23.5)	5.6 (18.2)	3.7 (12.1)	2.3 (7.7)
1500 MHz	12.1 (39.8)	9.4 (30.7)	7.3 (23.9)	4.9 (16.0)	3.1 (10.2)
2000 MHz	14.1 (46.3)	10.9 (35.8)	8.5 (27.9)	5.7 (18.7)	3.7 (12.1)
2500 MHz	15.9 (52.0)	12.3 (40.3)	9.6 (31.5)	6.4 (21.1)	4.2 (13.7)

	LMR-200-75-FR	LMR-240-75-FR	LMR-300-75-FR	LMR-400-75-FR	LMR-600-75-FR
<b>Average Power: Watts (+40°C Ambient; Sea Level)</b>					
150 MHz	430	620	910	1320	2080
450 MHz	250	350	510	740	1160
900 MHz	170	250	360	520	800
1500 MHz	130	190	270	390	600
2000 MHz	110	160	230	330	510
2500 MHz	100	140	210	300	450

# Connectors

## EZ Connectors – non sold-pin for LMR®-FR, field installable

Cable Type	LMR-195-FR	LMR-240-FR	LMR-300-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR
TNC Male Straight	TC-195-TM-X (3190-2879)	EZ-240-TM-X (3190-2725)	EZ-300-TM-X (3190-2421)	EZ-400-TM-X (3190-2533)	TC-500-TM-X (3190-6009)	EZ-600-TM-X (3190-2531)
TNC Male Right Angle	-	EZ-240-TM-RA-X (3190-2726)	-	EZ-400-TM-RA-X (3190-2800)	-	EZ-600-TM-RA-X (3190-2999)
TNC Female	-	EZ-240-TF-X (3190-6204)	-	EZ-400-TF-X (3190-3049)	TC-500-TF-X (3190-6010)	EZ-600-TF-X (3190-3050)
N Male Straight	TC-195-NMH-X (3190-2880)	EZ-240-NMH-X (3190-2893)	EZ-300-NMH-X (3190-2420)	EZ-400-NMH-X (3190-2590)	EZ-500-NMH-X (3190-2596)	EZ-600-NMH-X (3190-2627)
N Male Right Angle	TC-195-NMH-RA-D (3190-2425)	EZ-240-NMH-RA-X (3190-6143)	TC-300-NMH-RA-D (3190-2761)	EZ-400-NMH-RA-X (3190-2638)	TC-500-NMH-RA-D (3190-2970)	EZ-600-NMH-RA-X (3190-2639)
N Female	-	EZ-240-NF-X (3190-2795)	TC-300-NF-X (3190-3078)	EZ-400-NF-X (3190-2818)	TC-500-NFC (3190-215)	EZ-600-NF-X (3190-2817)
SMA Male Straight	EZ-195-SM-X (3190-6140)	EZ-240-CM-X (3190-6319)	TC-300-SM (3190-501)	TC-400-SM-X (3190-3046)	TC-500-SMC (3190-249)	-
SMA Male Right Angle	-	EZ-240-SM-RA-X (3190-2899)	-	-	-	-

## TC Connectors - sold pin for LMR®-UF-FR

Cable Type	LMR-195-UF-FR	LMR-240-UF-FR	LMR-400-UF-FR	LMR-500-UF-FR	LMR-600-UF-FR
TNC Male Straight	TC-195-TM-X (3190-2879)	TC-240-TM-X (3190-2797)	TC-400-TM (3190-260)	TC-500-TM (3190-464)	TC-600-TM-X (3190-2530)
TNC Male Right Angle	SC-195-TM-RA (3190-2468)	SC-240-TM-RA-D (3190-2798)	TC-400-TM-RA-D (3190-2671)	-	TC-600-TM-RA-D (3190-2707)
TNC Female	-	-	TC-400-TF-X (3190-3051)	TC-500-TF-X (3190-6010)	TC-600-TF-X (3190-3052)
N Male Straight	TC-195-NMH-X (3190-2880)	TC-240-NMH-X (3190-2887)	TC-400-NM (3190-188)	TC-500-NMH-X (3190-2514)	TC-600-NMH-X (3190-2628)
N Male Right Angle	TC-195-NMH-RA-D (3190-2425)	TC-240-NMH-RA-D (3190-2426)	TC-400-NMH-RA-D (3190-2293)	TC-500-NMH-RA-D (3190-2970)	TC-600-NMH-RA-D (3190-2427)
N Female	SC-195-NF (3190-2400)	-	TC-400-NF-X (3190-2815)	TC-500-NFC (3190-215)	TC-600-NF-X (3190-2816)
SMA Male Straight	TC-195-SM-SS-X (3190-2878)	TC-240-SM-SS-X (3190-2898)	TC-400-SM (3190-439)	-	-
SMA Male Right Angle	SC-195-SM-RA (3190-2242)	SC-195-SM-RA (3190-2813)	-	-	-

## EZ Connectors – non sold-pin for LMR®-75-FR, field installable

Cable Type	LMR-200-75-FR	LMR-240-75-FR	LMR-300-75-FR	LMR-400-75-FR	LMR-600-75-FR
BNC Male Straight	TC-200-BM-75-X (3190-6000)	EZ-240-BM-75-X (3190-6261)	TC-300-BM-75-X (3190-2959)	TC-400-BM-75-X (3190-2960)	-
BNC Female Straight	TC-200-BF-75-X (3190-6001)	EZ-240-BF-75-X (3190-6426)	-	-	-
F Male Straight	EZ-200-FM-75-X (3190-6412)	EZ-240-FM-75-X (3190-6411)	EZ-300-FM-75 (3190-1615)	EZ-400-FM-H-75 (3190-1617)	EZ-600-FM-75-X (3190-6410)
N Male Straight	EZ-200-NMH-75-X (3190-6409)	EZ-240-NMH-75-X (3190-6284)	EZ-300-NM-75 (3190-1616)	EZ-400-NMH-75-X (3190-6408)	EZ-600-NM-75 (3190-1620)

# Tools

## Crimp Tools:



CT-240/200/100



CT-400/300



CT-500



CT-600



CT-U



Y1719

## Strip Tools:



CST-195/200



CST-240A



CST-300



CST-400



CST-500



CST-600

## Cutting Tools:



CCT-02

## Deburring:



DBT-U

## Wrenches:



## Tool Kits:



## Cold Shrink Kits:



## WSB Boots:



## Grounding Kits;



# Lightning Protector

## LP-BTR/LP-BTRW Series DC Blocked (20-1000MHz)



- DC Blocked Design
- Multi-strike Capability
- Broad Band Performance up to 1GHz
- Exceptional RF Characteristics
- Universal Bulkhead and Flange Mounting
- Weatherization Gasket included
- Phosphor Bronze Center Pin Construction
- Solid Brass Design / White Bronze Plating
- Insertion Loss: < 0.1dB
- Return Loss: < -26dB

## LP-STRH-N series DC blocked (700-2700MHz)



- Fully Weatherized Body to IP67
- Broadband RF Performance
- Multi-strike Capability
- Maintenance Free Design
- Maximum Surge Current: 50kA
- Throughput voltage: 440mV
- Throughput Energy: 700pJ
- PIM@ 900/1900/2100MHz: < -160dBc
- Insertion Loss: < 0.1dB
- Return Loss: < -26dB (900-2700MHz)

## LP-GPX-N series DC blocked (1000-2000MHz)



- Bidirectional Filter Based Design
- Outstanding IL/RL Characteristics
- DC Blocked RF path for Superior Performance
- Solid State DC Path Protection Circuit
- Fully Weatherized Housing
- Maximum Surge Current: 10kA
- Throughput energy: < 110μJ
- Insertion Loss: < 0.1dB
- Return Loss: < -20dB (1000-2000MHz)

## LP-WBX-N series DC blocked (2000-6000MHz)



- Filter based Protection Circuit
- Broadband Outstanding IL/RL
- DC Blocked for Superior Surge Performance
- Ultra Broadband Multi-Strike Design
- Fully Weatherized Housing
- Maximum Surge Current: 20kA
- Throughput Energy: < 150nJ
- Insertion Loss: < 0.2dB
- Return Loss: < -20dB (2000-6000MHz)

# Data Line

## Data Line Protection for Outdoor Applications



- IP67 Weatherized for outdoor use
- Tested to RFC2544 extended methods
- Meets Network Equipment Building System (NEBS) Level 3
- Excellent data integrity
- Lowest surge and energy throughput
- Lowest error rate

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- Meets Network Equipment Building System (NEBS) Level 3
- Excellent data integrity
- Lowest surge and energy throughput
- Lowest error rate

## Data Line Protection for Indoor Applications



## TCAT-6 & TCAT-6-DB & TCAT-6-FR Cables and Assemblies



- Outdoor rated & shielded
- TCAT-6-DB (direct burial)- 31871
- TCAT-6 (outdoor rated)- 31872
- TCAT-6-FR (low smoke FR)- 31873
- High coverage, tinned copper outer shield for grounding
- > 90 dB RF shielding
- Ripcord for easy jacket stripping
- Black PE jacket for excellent weather resistance, FR Jacket available
- Various length assemblies available with TCAT-RJ-45 connectors

# Leaky Cable

The communication between a base station and a mobile station is usually transmitted by radio.

At present, the constant development of the communication industry requires that the base station and mobile station can be connected at anytime and anywhere, but in some special construction environment. For instance, rail transit tunnel, the mobile communication effect of electromagnetic wave propagation, the radio waves have been hampered in the tunnel, especially the shortwave and ultra shortwave transmission attenuation is bigger, so the study of leakage cable also arises at the historic moment. For longer tunnel appliation, TMS offers additional leaky cable products.

TMS provides connectors such as 7/16, type N, TNC and various hangers as well.



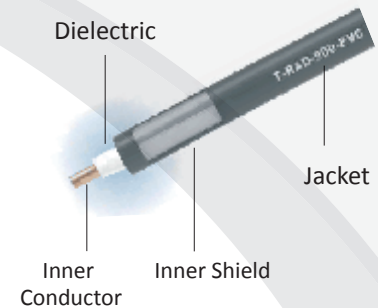


# Leaky Cable

## T-RAD

### Features:

- Provides RF coverage in train car's, railway station's, and enclosed areas
- Offers broad range of frequencies performance through 2.5GHz
- Flexible, non-kinking design provides easier installation



### Construction:

Center Conductor: Solid BCCAI / BC Tube  
 Dielectric: Foam PE  
 Inner Shield: Bonded Al Tape  
 Jacket: PVC or FRPE

	T-RAD-600-PVC	T-RAD-600-FR	T-RAD-900-PVC	T-RAD-900-FR
AA Number	9096	9097	9298	9630
Stock Number	44030	44031	44042	44046
<b>Physical Specifications</b>				
Description	in (mm)	in (mm)	in (mm)	in (mm)
Inner Conductor	Solid BCCAI	Solid BCCAI	BC Tube	BC Tube
	0.176 (4.47)	0.176 (4.47)	0.262 (6.65)	0.262 (6.65)
Dielectric	Foam PE	Foam PE	Foam PE	Foam PE
	0.455 (11.56)	0.455 (11.56)	0.680 (17.27)	0.680 (17.27)
Inner Shield	Bonded Al Tape	Bonded Al Tape	Bonded Al Tape	Bonded Al Tape
	0.458 (11.63)	0.458 (11.63)	0.686 (17.42)	0.686 (17.42)
Jacket	PVC	FRPE	PVC	FRPE
	0.530 (13.46)	0.530 (13.46)	0.870 (22.10)	0.870 (22.10)

	T-RAD-600-PVC	T-RAD-600-FR	T-RAD-900-PVC	T-RAD-900-FR
<b>Mechanical &amp; Environmental Specifications</b>				
Bend Radius: installation	1.50 (38.1)	1.50 (38.1)	3.00 (76.2)	3.00 (76.2)
Weight / lb/ft (kg/m)	0.09 (0.137)	0.09 (0.137)	0.266 (0.40)	0.266 (0.40)
Operating Temperature Range	-40 °F / +185 °F (-40°C / +85°C)		-40 °F / +185 °F (-40°C / +85°C)	

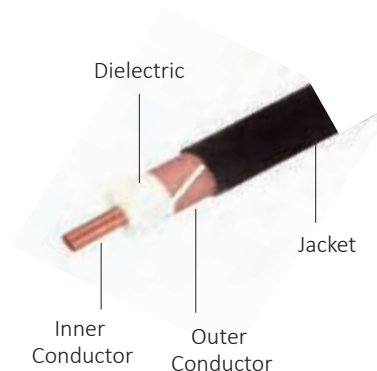
	T-RAD-600-PVC	T-RAD-600-FR	T-RAD-900-PVC	T-RAD-900-FR
<b>Electrical Specifications</b>				
Velocity of Propagation	86%	86%	87%	87%
Time Delay / nS/ft (nS/m)	1.18 (3.87)	1.18 (3.87)	1.17 (3.83)	1.17 (3.83)
Impedance/ ohms	50	50	50 ohms	50 ohms
Voltage Withstand / Volts DC	4000	4000	5000	5000
Jacket Spark / Volts RMS	6000	6000	8000	8000

# Leaky Cable

## NuRAD

### Features:

- Provides RF coverage in tunnel's and enclosed areas
- Offers broad range of frequencies performance through 2.5GHz
- Flexible, non-kinking design provides easier installation



### Construction:

Center Conductor: BC Tube  
 Dielectric: Foam PE  
 Outer Conductor: Bare Copper Slotted Tape  
 Jacket: FR PE

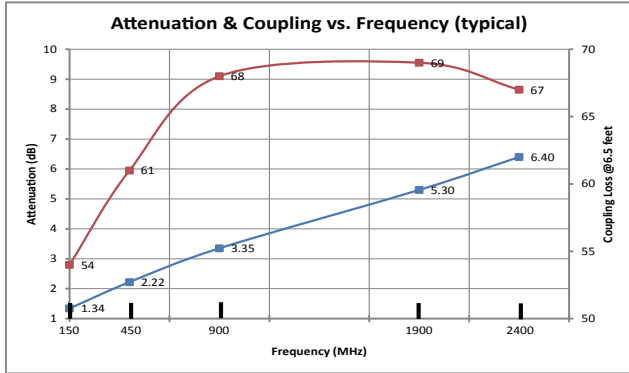
	NuRAD-875-FR	NuRAD-1250-FR	NuRAD-1625-FR
Size	7/8"	1-1/4"	1-5/8"
AA Number	60054	60055	60056
<b>Physical Specifications</b>			
<b>Description</b>	in (mm)	in (mm)	in (mm)
Center Conductor	BC Tube	BC Tube	BC Tube
	0.354 (9.0)	0.516 (13.1)	0.681 (17.3)
Dielectric	Foamed PE	Foamed PE	Foamed PE
	0.894 (22.7)	1.311 (33.3)	1.693 (43.0)
Slotted Outer Conductor	Bare Copper Slotted Tape	Bare Copper Slotted Tape	Bare Copper Slotted Tape
	0.906 (23.0)	1.323 (33.6)	1.713 (43.5)
Jacket	FR PE	FR PE	FR PE
	1.016 (25.8)	1.496 (38.0)	1.890 (48.0)

	NuRAD-875-FR	NuRAD-1250-FR	NuRAD-1625-FR
<b>Mechanical Specifications</b>			
Slot Design	Groups of Vertical Slots at Short Intervals		
Polarization	Vertical	Vertical	Vertical
Min. Bending Radius (Installation)	13.78 (350.0)	19.69 (500.0)	27.56 (700.0)
Tensile Force > lb (N)	449.6 (2000)	517.1 (2300)	674.5 (3000)
Weight (lbs/1000 ft)	329.3	537.7	672.1
Min. Distance to Wall	3.94 (100.0)	3.94 (100.0)	3.94 (100.0)
Recommended Clamp Spacing (ft/m)	3.28 (1.0)	3.28 (1.0)	3.28 (1.0)

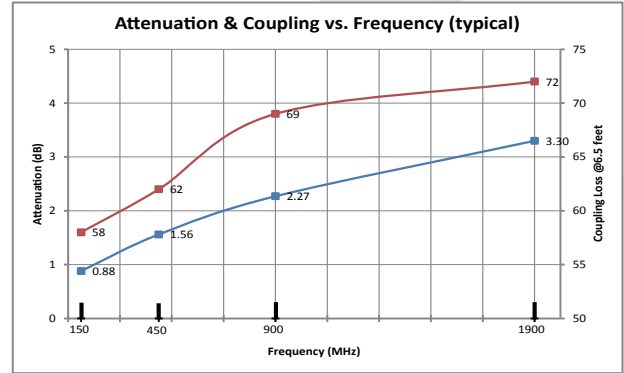
	NuRAD-875-FR	NuRAD-1250-FR	NuRAD-1625-FR
<b>Electrical Specifications</b>			
Stop Bands MHz	1300 to 1400	1100 to 1500	1100 to 1500
Impedance ohms	50 +/-2	50 +/-2	50 +/-2
Velocity	88%	89%	90%
Operation Temperature °C	-40 °C to +85 °C		

# Leaky Cable

T-RAD-600



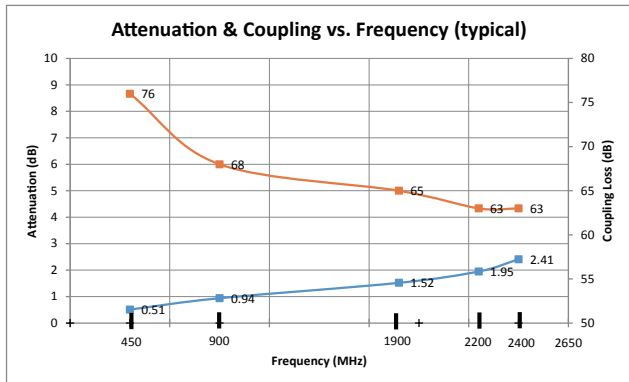
T-RAD-900



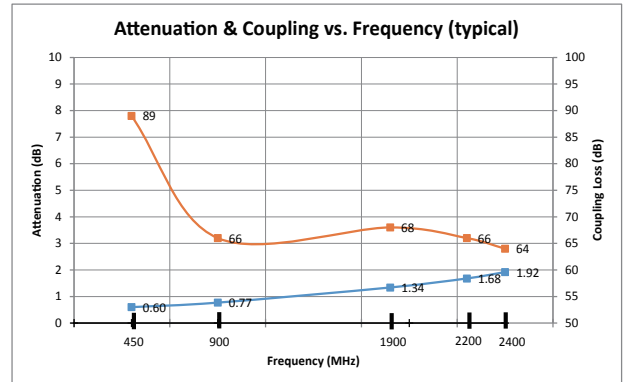
Attenuation: dB/100ft (100m), @20°C	150 MHz	450 MHz	900 MHz	1900 MHz	2400 MHz
T-RAD-600	1.34 (4.39)	2.22 (7.28)	3.35 (10.98)	5.30 (17.38)	6.40 (20.99)
T-RAD-900	0.88 (2.89)	1.56 (5.12)	2.27 (7.44)	3.30 (10.8)	

Coupling Loss: 50% dB	150 MHz	450 MHz	900 MHz	1900 MHz	2400 MHz
T-RAD-600	54	61	68	69	67
T-RAD-900	58	62	69	72	

NuRAD-1250-FR



NuRAD-1625-FR



Attenuation: dB/100ft (100m), @20°C	450 MHz	900 MHz	1800 MHz	2200 MHz	2400 MHz
NuRAD-1250-FR	0.51 (1.67)	0.94 (3.10)	1.52 (4.99)	1.95 (6.40)	2.41 (7.90)
NuRAD-1625-FR	0.60 (1.97)	0.77 (2.53)	1.34 (4.40)	1.68 (5.52)	1.92 (6.30)

Coupling Loss: 50% dB / 95% dB	450 MHz	900 MHz	1800 MHz	2200 MHz	2400 MHz
NuRAD-1250-FR	76 / 83	68 / 72	65 / 70	63 / 70	63 / 69
NuRAD-1625-FR	89 / 95	66 / 71	68 / 71	66 / 69	64 / 69

## MISSION

TIMES MICROWAVE SYSTEMS designs and manufactures high performance RF and microwave transmission lines. These products consist of coaxial cables, connectors, accessories and cable assemblies.

We are committed to understanding the needs and requirements of our customers and providing highly engineered, cost effective products.

TIMES MICROWAVE SYSTEMS is dedicated to total customer satisfaction and superior results for our shareholders in all we do.



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