LMR®

FLEXIBLE COMMUNICATIONS COAX

2007 Edition

NEW in this catalog:

LMR® lite coax cables

Special Products section

Part and Reference guide

World Class Products for Wireless Applications

The History of TMS

Times Microwave Systems (TMS) was founded in 1948 as the Times Wire and Cable Company. TMS is an engineering oriented organization specializing in the design and manufacture of high performance flexible and semi-rigid coaxial cable, connectors, and cable assemblies for RF transmission from HF through Microwave frequencies. TMS is committed to continuous improvement with respect to ISO-9001 Quality Standards and ISO-14001 Environmental Management Systems.

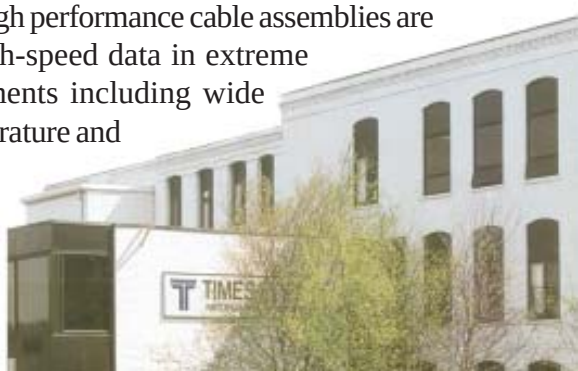
The expertise that provided cable solutions for the demanding requirements of airborne electronic warfare systems and led the way in the development of low smoke cables for shipboard applications is now yielding high performance cables to meet the needs of the wireless communications market. The innovative product line provides a better alternative to corrugated copper cables for antenna feeders and system interconnects. Compared to corrugated copper cables, LMR cables offer better flexibility, resistance to linking, comparable attenuation, and easier connector attachment at a lower cost.

The work performed at TMS in the 60's, 70's, and 80's forms the basis for today's high performance coaxial cables. TMS pioneered the development of closed cell low loss polyethylene foam dielectric and low loss taped PTFE dielectric coaxial cables. Through a thorough understanding of transmission line theory and manufacturing processes, TMS was the first to produce cables with reduced periodicity and impedance matched interfaces, resulting in the first transmission lines with low VSWR over broadband frequency ranges up to 40 GHz. The development of connector design and manufacturing expertise allowed TMS to take full performance responsibility for the entire cable assembly, which was unprecedented at the time.

TMS has been instrumental in the development of military specifications, including MIL-C-17 for coaxial cables. Times is the leading source of MIL-C-17 qualified products, holding far more QPL's (Qualified Product Listings) than any other manufacturer in the world. Times also helped the US Navy write the MIL-T-81490 Transmission Line Specification, and is qualified to supply microwave transmission lines that meet MIL-T-81490 and MIL-C-87104 (US Air Force) requirements. These are the specifications that define harsh military airborne environments that Electronic Warfare transmission lines must perform in, year after year.

TMS applies its expertise to customer requirements through a staff of Field Application Engineers. Unlike other cable manufacturers with limited product lines, who try to fit customer applications to their existing products, the philosophy of TMS is to select or design the right product for the application. This results in an optimal and cost effective solution.

TMS is the leader in the design, qualification, manufacture, and on-time delivery of high performance cable and cable assembly products to the commercial wireless and military marketplace. In 2003, TMS was selected by Lockheed Martin Aeronautics to supply the Broadband Airborne Cable Assemblies on the F-35 Joint Strike Fighter (JSF). TMS was chosen to supply this solution since its high performance cable assemblies are able to handle high-speed data in extreme avionics environments including wide variations in temperature and pressure.



Contents

LMR® discussion

What is LMR® cable?

Times LMR cables are high performance broadband, flexible, low loss 50 Ohm coaxial communication cables designed for use in wireless applications such as:

- 2-way land mobile
- IEEE, 802. 11a & 802.11b
- Cellular
- Wireless local loop
- PCS
- LMDS
- Wireless Internet (WISP)
- MMDS
- Broadband wireless data
- CLEC
- Telemetry
- Paging

LMR is a complete system of cables, connectors, installation tools and accessories- everything you need to make your job simple and successful.

Where can LMR® cables be used?

Times LMR cables can be used virtually anywhere high performance coaxial cables are used, including:

- Internal component and equipment wiring
- Inter/intra cabinet jumpers
- Base station and antenna jumpers
- Tower and pole feeder runs
- In-building runs, including riser runs and air-handling plenums
- Rooftop installations

What sizes of LMR® cable are available?

A full range of LMR cables are available from LMR-100 (0.100") all the way up to LMR-1700-DB (1 1/4"). Because LMR cables are so flexible, it's possible to eliminate jumpers entirely in many feeder cable applications. The elimination of jumper cables provides reduced cost, better reliability and lower cost- or may even allow the use of a smaller size feeder cable, while achieving the same loss as for a larger corrugated feeder.

What are the advantages of LMR®?

Times LMR cables have RF performance comparable to traditional corrugated copper cables, but unlike corrugated cables they are highly flexible, non-kinking, and offer unsurpassed ease and speed of connector installation. Compared to RG type braided cables, LMR cables offer far lower loss and better RF shielding. These features make LMR cables the best choice for *any* wireless application.

What makes LMR® cable different than corrugated cables?

Design features of Times LMR cable include:

1) Polyethylene Foam Dielectric

- Closed cell
- Dry nitrogen gas injected- no moisture to degrade performance
- High velocity
- Low loss

2) High Performance Flexible Shielding System

- Multi-laminar aluminum composite tape bonded to the dielectric

- Provides >90dB isolation shielding (180dB cross talk)
- Bonded construction ensures 100% effective shielding
- Acts as a second moisture barrier

• Outer Braid of tinned copper:
- Provides positive means for grounding and connector attachment

3) Polyethylene Outer Jacket

• Heavy duty UV, sunlight and weather resistant, 20 to 40 year life

How does LMR® cable compare to RG type braided cable or 9913?

LMR cables have lower loss and far better shielding than comparably sized braided cables. Polyethylene jacket, closed cell foam poly dielectric and bonded tape conductor all contribute to the superior weather resistance of LMR cables compared to braided cables and 9913.

Is there only one type of LMR® cable, or are there options?

Included in this catalog are the many different types of LMR cables which are available, so you can always be certain that there is an LMR cable just right for your particular application. Besides standard LMR cable, Times offers:

LMR-FR: Fire retardant cable for installation in building vertical risers or where fire retardancy is critical, both UL and CSA listed (CMR/CATVR).

LMR-LLPL: Low loss plenum rated cables for use in virtually any in-building application, including air handling plenums and spaces where maximum fire retardancy and low smoke generation are required. LMR-LLPL cables are the most rugged and easiest to install plenum rated cables available, especially for difficult installs in older buildings. Cables are both UL and CSA listed (CMP/CATVR).

LMR-DB: Watertight cables with an inert flooding compound injected in the braid to completely eliminate the possibility of any water migration- *with a 10 year warranty!* The DB feature is optional on sizes 600 and smaller, and standard on sizes 900 and larger.

LMR Ultraflex: Stranded center conductor and thermoplastic rubber jacket for maximum flexibility.

LMR-MA: Unbonded tape conductor for ease of removal for special applications.

LMR-PVC: Polyvinylchloride outer jacket for enhanced flexibility.

LMR-lite: Lightweight version of the standard LMR cable. Aluminum braid is used instead of tinned copper braid to offer a lighter weight cable.

FBT: Similar to LMR-LLPL, but with a fluoropolymer (FEP) outer jacket for high temperature performance up to 150°C (302°F).

T-COM: The ultimate in low loss, high performance coax with a triple shielding system pioneered by Times to achieve enhanced shielding and low passive intermod (-155dB).

LMR-75: These are 75 Ohm versions of the standard LMR cable for unsurpassed performance in broadband video and specialized RF applications.

T-RAD: 50 Ohm leaky feeder cable for RF coverage up to 2.5GHz. For use in buildings, mines, tunnels or any enclosed area. Flexible, non-kinking low cost design.

LMR® discussion

What about connectors and installation tools?

Times offers a complete line of connectors for all its cables. A wide variety of connector interfaces is offered for almost every application:

- N
- BNC
- TNC
- UHF
- Reverse polarity
- MUHF
- 716DIN
- SMA
- QDS (quick disconnect)
- F
- LC
- HN
- QMA

Special connectors are available, and Times is always adding new ones. Times also offers a complete line of cable prep and connector installation tools, so you never will be frustrated by not having the right tools- Times is your one-stop source.

Do all Times connectors require soldering?

An extensive line of solder-pin type connectors is offered. However, Times has become the recognized industry leader in developing simplified connectors especially suited for field applications offering more non-solder type connectors than any other cable manufacturers. The Times well-known line of ***EZ*** non-solder connectors has become renowned in the industry. With center pin contacts made from silver or gold plated beryllium-copper, ***EZ*** connectors are the preferred choice for quick and reliable field installations.

How can I get cable and tower installation accessories that work with LMR® cable?

Easy- Times furnishes a complete line of site installation hardware and accessories- everything you need to get you from the antenna to the equipment:

- **Ground kits:** Perfectly sized to each LMR cable, with never a chance of the ground strap being too tight (crushed cable), or too loose (poor grounding).
- **Hangers**: Snap-in, butterfly
- **Hoisting grips**
- **Weatherproofing kits:** Tape and cold shrink
- **Tie wraps**
- **Mounting hardware**
- **Entry ports and hardware**

Does anyone else make a cable like LMR®?

Some have tried, but no one can match Times LMR when it comes to what's important to the customer. Some don't even offer anything but cable, while Times offers:

- The most complete line of cable, connectors (including ***EZ***), tools and accessories
- The biggest range of sizes
- The most cable type options
- The most extensive distribution network
- Unsurpassed technical support
- The assurance that comes from knowing you are dealing with the industry leader, and
- ***The only company with its phone number printed on every foot of cable we make.*** You never have to guess who to call if you have a question or need help solving a problem, because everything is supplied by Times.

What about price?

In most cases Times LMR cables and connectors will save you money compared to corrugated cable. By combining the lower purchase cost with the ease and speed of installation, excellent savings are achieved. LMR cables also offer significant performance advantages compared to RG type cables at comparable prices.

How about jumpers and cable assemblies?

Times manufactures high quality LMR cable assemblies and Flextech jumpers- 100% factory tested before shipment for insertion loss and VSWR. Many of Times' LMR distributors also supply LMR cable assemblies and provide excellent service, especially for quick delivery requirements.

Where are LMR® cables made?

Times LMR cables are manufactured in our ISO certified Wallingford, Connecticut plant, where we have been making high quality coaxial cable for over 50 years.

What about availability?

Times LMR cables, connectors and accessories are stocked by our vast network of national, regional and international distributors worldwide, so you are never far from a convenient source.

How can I get started using LMR® cables?

Easy- just call our friendly Sales Department at either 1-800-TMS-COAX (1-800-867-2629) or 203-949-8400 and you can also visit our comprehensive web site at www.timesmicrowave.com for product and technical information or to request other Times literature.

I'm new at this and might need help with the connectors or accessories

Times has put together a CD-ROM with full "how-to" videos of many of the most popular EZ connectors as well as ground kits and other accessories. It also includes all our catalogs and a convenient Loss Calculator. We'd be glad to send you one to help you do the job right, so just call us or e-mail us and we'll get one right out to you. And if you ever need help on a job, just call us- our phone number is right on the cable.

TIMES MICROWAVE SYSTEMS

LMR®-100A
Flexible Low Loss Communications Coax

Ideal for...

- Drop-in Replacement for RG-316/RG-174 (uses standard connectors)
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.
• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-100A cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
• **Low Loss** is another hallmark feature of LMR-100A. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
• **Weatherability**: LMR-100A cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.
• **Connectors**: A wide variety of connectors are available for LMR-100A cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.
• **Cable Assemblies**: All LMR-100A cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
LMR-100A-FR	Indoor-Riser CMR	FRPE	Black	54037
LMR-100A-PVC	Indoor/Outdoor	PVC	Black	54119
LMR-100A-PVC-W	Indoor/Outdoor	PVC	White	54200

PVC = Poly Vinyl Chloride; MTO = Made to Order

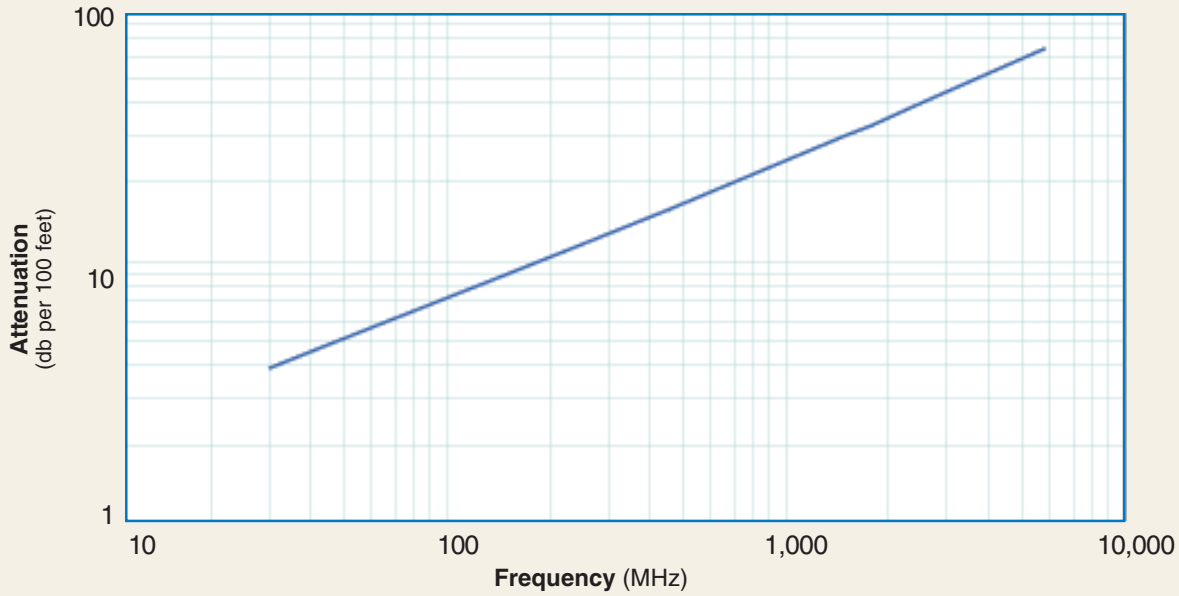
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCS	0.018	(0.46)
Dielectric	Solid PE	0.060	(1.52)
Outer Conductor	Aluminum Tape	0.065	(1.65)
Overall Braid	Tinned Copper	0.083	(2.11)
Jacket	(see table above)	0.110	(2.79)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.25	(6.4)
Bend Radius: repeated	in. (mm)	1	(25.4)
Bending Moment	ft-lb (N-m)	0.1	(0.014)
Weight	lb/ft (kg/m)	0.0092	(.014)
Tensile Strength	lb (kg)	15	(6.8)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

Environmental Specifications		
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

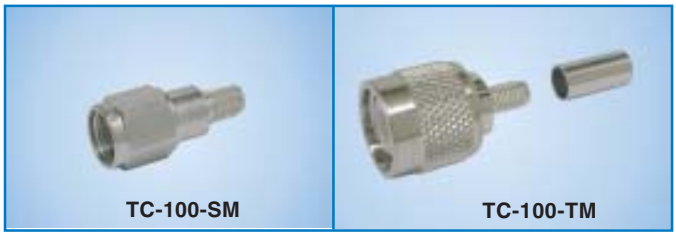
Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	90	
Velocity of Propagation	%	66	
Dielectric Constant	NA	2.30	
Time Delay	nS/ft (nS/m)	1.54	(5.05)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	30.8	(101.1)
Inductance	uH/ft (uH/m)	0.077	(0.25)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	81.0	(266)
Outer Conductor	ohms/1000ft (/km)	9.5	(31.2)
Voltage Withstand	Volts DC	500	
Jacket Spark	Volts RMS	2000	
Peak Power	kW	0.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	3.9	5.1	8.9	10.9	15.8	22.8	30.1	33.2	35.2	39.8	64.1
Attenuation dB/100 m	12.9	16.7	29.4	35.8	51.9	74.9	98.7	109.0	115.5	130.6	210.3
Avg. Power kW	0.230	0.180	0.100	0.083	0.057	0.039	0.029	0.027	0.025	0.022	0.013

Calculate Attenuation = (0.709140) • $\sqrt{\text{FMHz}}$ + (0.001740) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading


TC-100-SM

TC-100-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR ** Freq.	(GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
SMA male	Straight Plug	TC-100-SM	3190-1551	<1.25:1	(<3)	Hex	Solder	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.015	(6.8)
TNC male	Straight Plug	TC-100-TM	3190-1552	<1.25:1	(<3)	Knurl	Solder	Crimp	S/G	1.4	(35.6)	0.59	(15.0)	0.045	(20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


CT-240/200/195/100

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CCT-01

TIMES MICROWAVE SYSTEMS

LMR®-195
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable
- Drop-in replacement for RG-58 and RG-142

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **LMR®- FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **LMR®- MA** is a flexible cable designed specifically for mobile antenna applications. It has a PVC jacket and un-bonded aluminum tape to facilitate end stripping with automated equipment.

• **Flexibility** and bendability are hallmarks of the LMR-195 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-195. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-195 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for LMR-195 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-195 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-195	Outdoor	PE	Black	54110
LMR-195-DB	Outdoor/Watertight	PE	Black	54113
LMR-195-FR	Indoor-Riser CMR	FRPE	Black	54111
LMR-195-FR-W	Indoor-Riser CMR	FRPE	White	54158
LMR-195-FR-PVC	Indoor-Riser CMR	FRPVC	Black	54105
LMR-195-MA	Mobile Antennas	PVC	Black	54210
LMR-195-PVC	Indoor/Outdoor	PVC	Black	54215
LMR-195-PVC-W	Indoor/Outdoor	PVC	White	54199

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Foam PE	0.110	(2.79)
Outer Conductor	Aluminum Tape	0.116	(2.95)
Overall Braid	Tinned Copper	0.139	(3.53)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.021	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

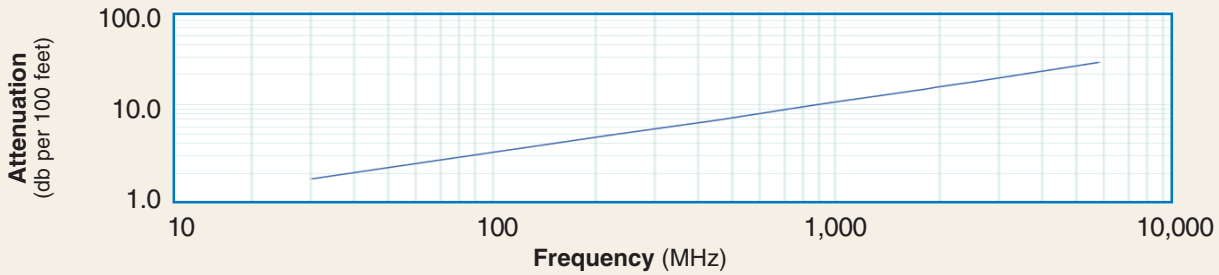
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	25.4	(83.3)
Inductance	uH/ft (uH/m)	0.064	(0.21)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.6	(24.9)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.0	2.5	4.4	5.4	7.8	11.1	14.5	16.0	16.9	19.0	29.9
Attenuation dB/100 m	6.5	8.4	14.6	17.7	25.5	36.5	47.7	52.5	55.4	62.4	98.1
Avg. Power kW	0.89	0.68	0.39	0.32	0.22	0.16	0.12	0.11	0.10	0.09	0.06

Calculate Attenuation = (0.356859) • $\sqrt{\text{FMHz}}$ + (0.000470) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading


TC-195-NM


TC-195-SM


TC-195-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	SG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	SG	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100,195, 200 and 240connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CT-240/200/195/100


CCT-01

TIMES MICROWAVE SYSTEMS

LMR®-200
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **LMR®- FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **LMR®- MA** is a flexible cable designed specifically for mobile antenna applications. It has a PVC jacket and un-bonded aluminum tape to facilitate end stripping with automated equipment.

• **Flexibility** and bendability are hallmarks of the LMR-200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for LMR-200 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-200	Outdoor	PE	Black	54022
LMR-200-DB	Outdoor/Watertight	PE	Black	54089
LMR-200-FR	Indoor-Riser CMR	FRPE	Black	54028
LMR-200-FR-PVC	Indoor-Riser CMR	FRPVC	Black	54125
LMR-200-PVC	Indoor/Outdoor	PVC	Black	54216
LMR-200-PVC-W	Indoor/Outdoor	PVC	White	54201
LMR-200-MA	Mobile Antennas	PVC	Black	54045

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Tinned Copper	0.144	(3.66)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.022	(0.03)
Tensile Strength	lb (kg)	40	(48)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

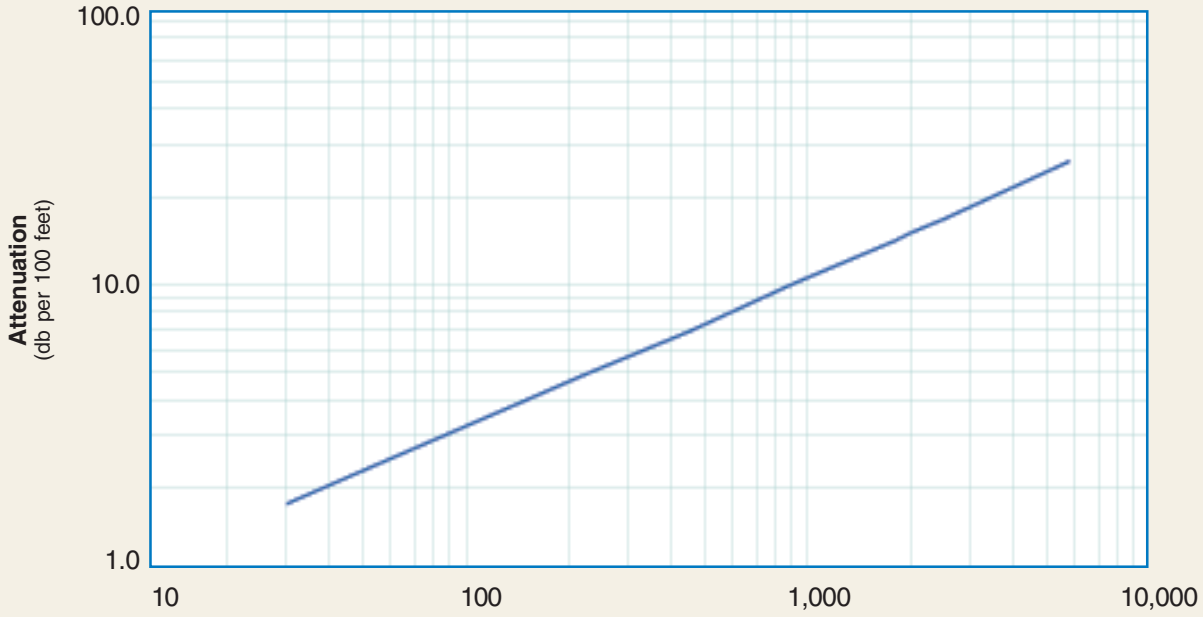
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.8	2.3	4.0	4.8	7.0	9.9	12.9	14.2	15.0	16.9	26.4
Attenuation dB/100 m	5.8	7.5	13.1	15.9	22.8	32.6	42.4	46.6	49.3	55.4	86.5
Avg. Power kW	1.02	0.79	0.45	0.37	0.26	0.18	0.14	0.13	0.12	0.11	0.07

Calculate Attenuation =
$(0.320900) \bullet \sqrt{FMHz} + (0.000330) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-200
Flexible Low Loss Communications Coax


TC-200-BM


TC-200-MUHF


EZ-200-NM


EZ-200-NM-D


TC-200-NM


TC-200-NM-RP


TC-200-SM


TC-200-SM-RP


EZ-200-TM


TC-200-TMC


EZ-200-TM-RP


TC-200-TF


EZ-200-TF-RP

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
BNC male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)
N male	Straight Plug	EZ-200-NM	3190-1475	<1.25:1 (8)	Knurl	Spring Fit	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
N male	Straight Plug	EZ-200-NM-D	3190-1918	<1.25:1 (8)	Hex/Knurl	Spring Fit	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
N male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
N male	Reverse Polarity	TC-200-NM-RP	3190-959	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
SMA male	Straight Plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	EZ-200-TM	3190-1266	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045(20.4)
TNC male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045(20.4)
TNC male	Reverse Polarity	EZ-200-TM-RP	3190-792	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	A/G	1.4 (35.6)	0.32 (8.1)	0.045(20.4)
TNC female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.3 (33.0)	0.57 (14.5)	0.033(15.0)
TNC female	Reverse Polarity	EZ-200-TF-RP	3190-793	<1.25:1 (2.5)	NA	Spring Fit	Crimp	A/G	1.3 (33.0)	0.57 (14.5)	0.033(15.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

GK-S200TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200TT	GK-S200TT	Standard Ground Kit (each)

CT-240/200/195/100

CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-240
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs (e.g. WLL, GPS, LMR, Mobile Antennas)
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **LMR®- FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **LMR®- MA** is a flexible cable designed specifically for mobile antenna applications. It has a PVC jacket and un-bonded aluminum tape to facilitate end stripping with automated equipment.

• **Flexibility** and bendability are hallmarks of the LMR-240 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-240 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for LMR-240 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-240 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part Number	Application	Jacket	Color	Stock Code
LMR-240	Outdoor	PE	Black	54021
LMR-240-DB	Outdoor/Watertight	PE	Black	54090
LMR-240-FR	Indoor -Riser CMR	FRPE	Black	54029
LMR-240-FR-PVC	Indoor -Riser CMR	FRPVC	Black	54214
LMR-240-PVC	Indoor/Outdoor	PVC	Black	54140
LMR-240-PVC-W	Indoor/Outdoor	PVC	White	54202
LMR-240-MA	Indoor & Mobile Antenna	PVC	Black	54046

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.056	(1.42)
Dielectric	Foam PE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	(see table above)	0.240	(6.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile Strength	lb (kg)	80	(36.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

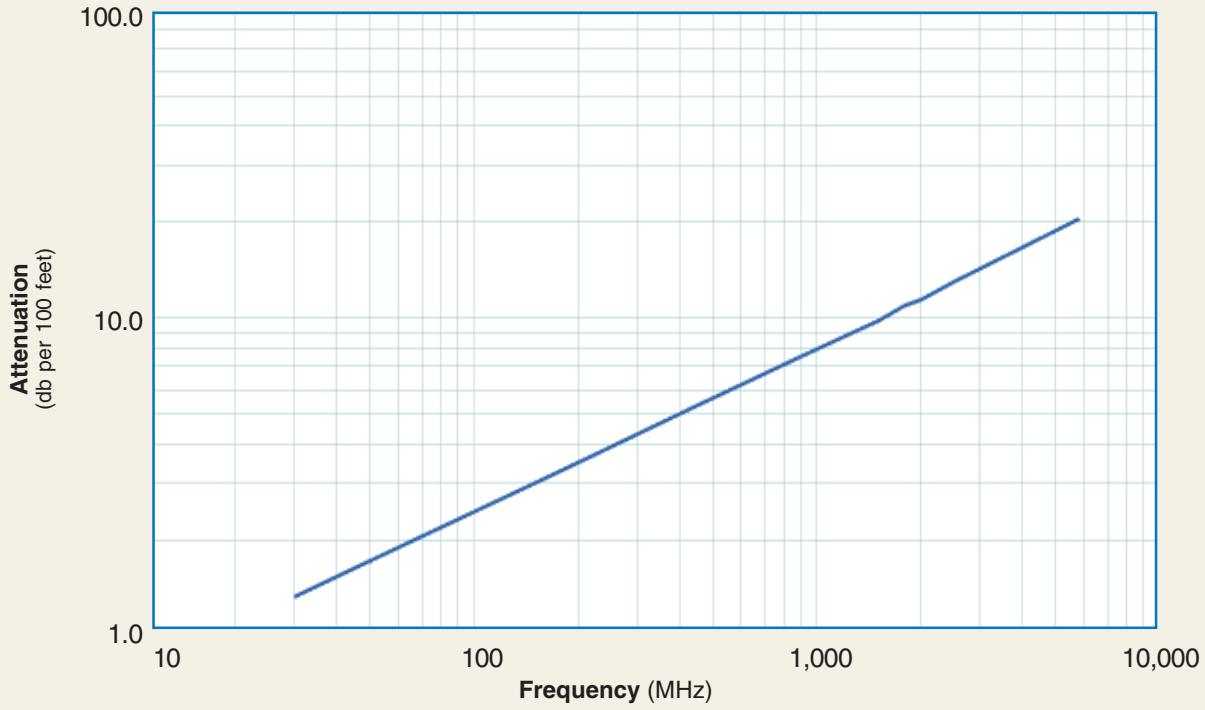
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	31	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	3.2	(10.5)
Outer Conductor	ohms/1000ft (/km)	3.89	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.3	1.7	3.0	3.7	5.3	7.6	9.9	10.9	11.5	12.9	20.4
Attenuation dB/100 m	4.4	5.7	9.9	12.0	17.3	24.8	32.4	35.6	37.7	42.4	66.8
Avg. Power kW	1.49	1.15	0.66	0.54	0.38	0.26	0.20	0.18	0.17	0.15	0.10

Calculate Attenuation =
$(0.242080) \bullet \sqrt{FMHz} + (0.000330) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-240
Flexible Low Loss Communications Coax

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
F Male	Straight Plug	TC-240-FM	3190-924	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.45	(11.4)	0.014	(6.4)
N Male	Straight Plug	EZ-240-NM-D	3190-1127	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Crimp	N/G	1.5	(38.1)	0.78	(19.8)	0.086	(39.0)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	N/S	1.5	(38)	0.75	(19.1)	0.086	(39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5	(38)	0.75	(19.1)	0.082	(37.2)
N Male	Right Angle	TC-240-NM-RA(A)	3190-868	<1.35:1 (2.5)	Hex	Solder	Crimp	A/G	1.3	(33)	1.14	(29.1)	0.105	(47.6)
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7	(44)	0.88	(22.2)	0.115	(52.2)
N Female	Panel Mount	TC-240-NF-BHF(A)	3190-866	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7	(44)	0.88	(22.2)	0.115	(52.2)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43)	0.56	(14.2)	0.040	(18.1)
BNC Male	Straight Plug	TC-240-BM(A)	3190-867	<1.25:1 (2.5)	Knurl	Solder	Crimp	A/G	1.7	(43)	0.5 6	(14.2)	0.043	(19.5)
TNC Male	Straight Plug	EZ-240-TM	3190-1128	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/G	1.4	(34.3)	0.59	(15.0)	0.043	(19.5)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.7	(43)	0.59	(15.0)	0.043	(19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.3	(33)	0.57	(14.5)	0.055	(24.9)
TNC Male	Reverse Polarity	EZ-240-TM-RP	3190-970	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	1.4	(36)	0.59	(15.0)	0.043	(19.5)
QMA Male	Straight Plug	EZ-240-QM	3190-1533	<1.25: (<18)	Knurl	Spring Finger	Crimp	N/G	1.2	(30.0)	0.41	(10.5)	0.014	(6.35)
QMA Male	Right Angle	EZ-240-QM-RA	3190-1539	<1.25: (<18)	Knurl	Spring Finger	Crimp	N/G	0.8	(20.3)	0.65	(16.5)	0.019	(8.62)
SMA Male	Straight Plug	EZ-240-SM	3190-1530	<1:25: (<18)	Hex	Spring Finger	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.016	(7.26)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8	(20)	0.65	(16.5)	0.019	(8.6)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1	(29)	0.31	(7.9)	0.019	(8.6)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.45	(11.4)	0.014	(6.4)

*Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


TC-240-SM-RA


TC-240-SM-RP


TC-240-SF-BH


TC-240-MUHF


EZ-240-QM


EZ-240-QM-RA


EZ-240-SM


TC-240-NF-BHF (A)


GK-S240TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240TT	GK-S240TT	Standard Ground Kit (each)


ST-240EZ


CT-240/200/195/100


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Strip Tool	ST-240EZ	3190-1880	Strip tool for EZ connectors
Deburr Tool	DBT-02	3190-1706	Deburring tool for LMR-240
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-300
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **LMR®- FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-300 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-300 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-300 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-300 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part Number	Application	Jacket Color	Stock Code
LMR-300	Outdoor	PE Black	54086
LMR-300-DB	Outdoor/Watertight	PE Black	54114
LMR-300-FR	Indoor -Riser CMR	FRPE Black	54087
LMR-300-FR-PVC	Indoor -Riser CMR	FRPVC Black	54108
LMR-300-PVC	Indoor/Outdoor	PVC Black	54217
LMR-300-PVC-W	Indoor/Outdoor	PVC White	54203

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.070	(1.78)
Dielectric	Foam PE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	(see table above)	0.300	(7.62)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

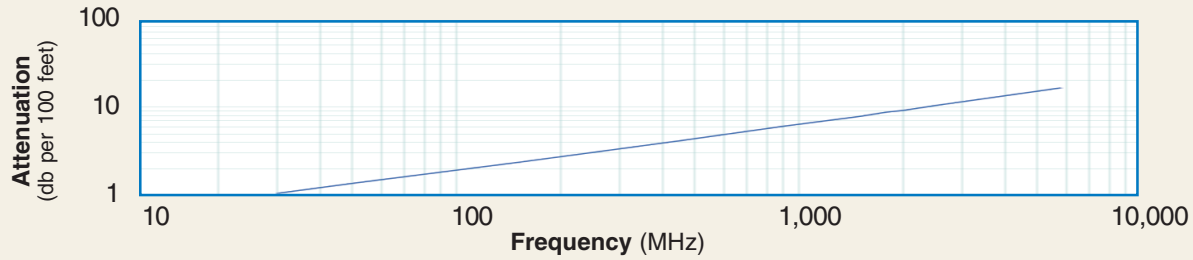
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	24.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.12	(7.0)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

TIMES MICROWAVE SYSTEMS

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.88	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuaton dB/100 ft	1.1	1.4	2.4	2.9	4.2	6.1	7.9	8.7	9.2	10.4	16.5
Attenuaton dB/100 m	3.5	4.5	7.9	9.6	13.8	19.9	26.0	28.7	30.3	34.2	54.2
Avg. Power kW	2.09	1.62	0.92	0.76	0.52	0.36	0.28	0.25	0.24	0.21	0.13

Calculate Attenuation = (0.191930) • $\sqrt{\text{FMHz}}$ + (0.000330) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-300-NM


TC-300-NM-RA


TC-300-TM


TC-300-SM


TC-300-SF-BH

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)		Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1	(6)	Knurl	Solder	Crimp	N/S	1.6	(41)	0.85	(21.6)	0.074	(33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1	(2.5)	Knurl	Solder	Crimp	N/S	1.5	(38)	0.85	(21.6)	0.101	(45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1	(2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.050	(22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1	(2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.35	(8.9)	0.018	(8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1	(2.5)	NA	Solder	Crimp	SS/G	1.1	(28)	0.31	(7.9)	0.022	(10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300TT	GK-S300TT	Standard Ground Kit (each)


GK-S300TT


CT-300/400


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR-300 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-400
Flexible Low Loss Communications Coax

Ideal for...

- Drop-in replacement for RG-8/9913 Air-Dielectric type Cable
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **LMR®- FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-400 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-400 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for LMR-400 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-400 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-400	Outdoor	PE	Black	54001
LMR-400-DB	Outdoor/Watertight	PE	Black	54091
LMR-400-FR	Indoor -Riser CMR	FRPE	Black	54030
LMR-400-FR-PVC	Indoor -Riser CMR	FRPVC	Black	54073
LMR-400-PVC	Indoor/Outdoor	PVC	Black	54218
LMR-400-PVC-W	Indoor/Outdoor	PVC	White	54204

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.108	(2.74)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	(see table above)	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.00	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.068	(0.10)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

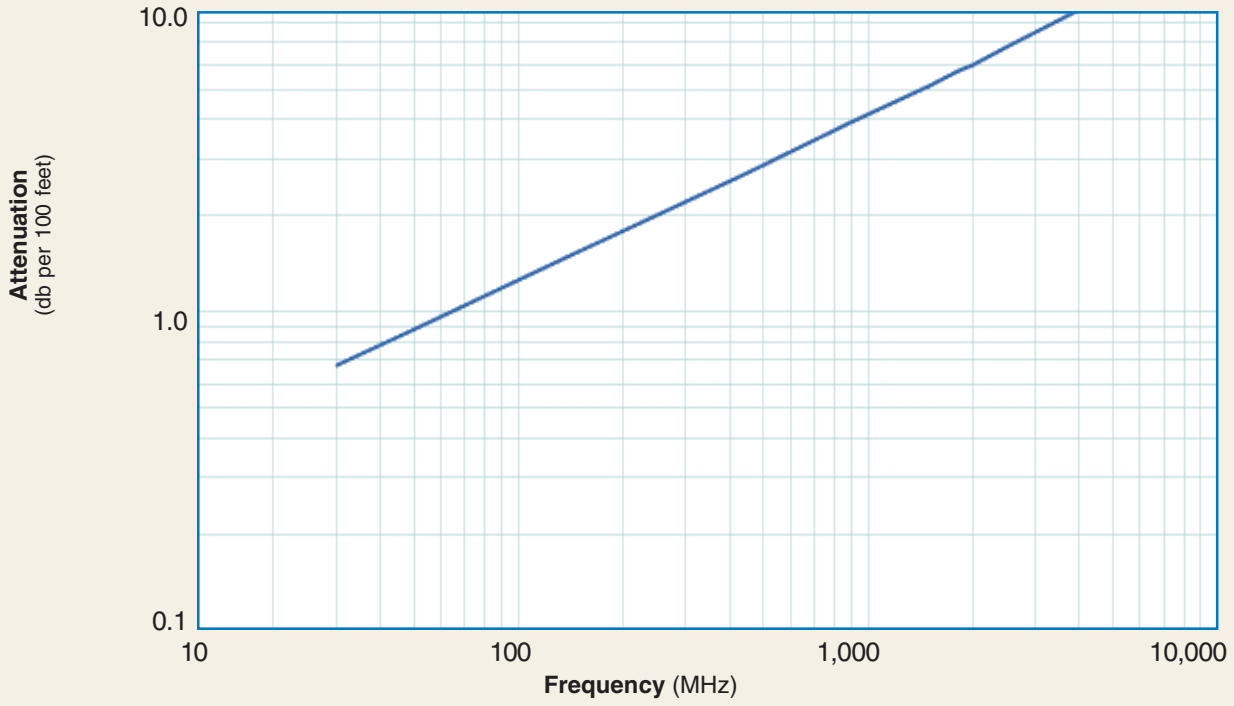
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	16.2	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.6)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.7	0.9	1.5	1.9	2.7	3.9	5.1	5.7	6.0	6.8	10.8
Attenuation dB/100 m	2.2	2.9	5.0	6.1	8.9	12.8	16.8	18.6	19.6	22.2	35.5
Avg. Power kW	3.33	2.57	1.47	1.20	0.83	0.58	0.44	0.40	0.37	0.33	0.21

Calculate Attenuation =
$(0.122290) \bullet \sqrt{FMHz} + (0.000260) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-400
Flexible Low Loss Communications Coax

Connectors

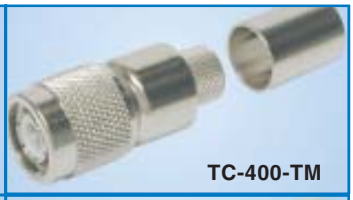
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Female	Straight Jack	TC-400-716-FC	3190-376	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	1.6	(41)	1.13	(28.7)	0.281	(127.5)
7-16 DIN Male	Straight Plug	TC-400-716-MC	3190-279	<1.25:1 (2.5)	Hex	Solder	Clamp	S/S	1.4	(36)	1.40	(35.6)	0.268	(121.6)
7-16 DIN Male	Right Angle	TC-400-716MC-RA	3190-1671	<1.25:1 (<3)	Hex	Solder	Clamp	A/S	2.4	(61.5)	1.88	(47.8)	0.35	(159)
BNC Male	Straight Plug	TC-400-BM	3190-318	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.56	(14.2)	0.063	(28.6)
HN Male	Straight Plug	TC-400-HNM	3190-923	<1.25: (<1)	Knurl	Solder	Clamp	S/G	2.3	(59.2)	0.88	(22.4)	0.25	(113.4)
QDS Male	Straight Plug	TC-400-QDSM	3190-620	<1.25: (<3)	Knurl	Solder	Clamp	A/G	1.8	(46.6)	1.00	(25.4)	0.25	(113.4)
Mini-UHF	Straight Plug	TC-400-MUHF	3190-520	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.50	(12.7)	0.020	(9.1)
N Female	Straight Jack	TC-400-NFC	3190-299	<1.25:1 (2.5)	NA	Solder	Clamp	N/S	1.6	(41)	0.75	(19.1)	0.119	(54.0)
	Straight Jack	EZ-400-NF	3190-956	<1.25:1 (2.5)	NA	Spring Finger	Crimp	N/G	1.8	(45)	0.66	(16.8)	0.105	(47.6)
	Bulkhead Jack	EZ-400-NF-BH	3190-518	<1.25:1 (2.5)	NA	Spring Finger	Crimp	N/G	1.8	(46)	0.88	(22.4)	0.102	(46.3)
	Bulkhead Jack	TC-400-NFC-BH (A)	3190-872	<1.25:1 (2.5)	NA	Solder	Clamp	A/G	1.8	(46)	0.88	(22.4)	0.145	(65.8)
N Male	Straight Plug	SC-400-NM	3190-1454	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
	Straight Plug	TC-400-NM	3190-188	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
	Straight Plug	TC-400-NMC	3190-277	<1.25:1 (2.5)	Knurl	Solder	Clamp	N/G	1.5	(38)	0.70	(17.8)	0.121	(54.9)
	Straight Plug	EZ-400-NFC-2	3190-1907	<1.25:1 (2.5)	NA	Spring Finger	Clamp	N/G	1.5	(38)	0.89	(22.6)	0.121	(54.9)
	Straight Plug	EZ-400-NMC-2	3190-1906	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Clamp	N/G	1.5	(38)	0.75	(19.1)	0.121	(54.9)
	Straight Plug	EZ-400-NMH-D	3190-400	<1.25:1 (10)	Hex/Knurl	Spring Finger	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.103	(46.8)
	Straight Plug	TC-400-NMH-D	3190-552	<1.25:1 (10)	Hex/Knurl	Solder	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.113	(51.3)
	Straight Plug	EZ-400-NMK	3190-661	<1.25:1 (10)	Knurl	Spring Finger	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.113	(51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8	(46)	1.25	(31.8)	0.130	(59.0)
	Right Angle	TC-400-NMC-RA (A)	3190-870	<1.35:1 (2.5)	Hex	Solder	Clamp	A/G	1.8	(46)	1.25	(31.8)	0.150	(68.0)
	Right Angle	EZ-400-NMH-RA	3190-761	<1.35:1 (2.5)	Hex	Spring Finger	Crimp	S/G	1.8	(46)	1.25	(31.8)	0.130	(59.0)
	Reverse Polarity	TC-400-NM-RP	3190-960	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
SMA Male	Straight Plug	TC-400-SM	3190-439	<1.25:1 (8)	Hex	Solder	Crimp	N/G	1.2	(29)	0.50	(12.7)	0.032	(14.5)
TNC Female	Reverse Polarity	TC-400-TF-RP	3190-1063	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.8	(46)	0.55	(14.0)	0.074	(33.6)
	Reverse Polarity	EZ-400-TF-RP	3190-795	<1.25:1 (2.5)	NA	Spring Finger	Crimp	A/G	1.8	(46)	0.55	(14.0)	0.074	(33.6)
TNC Male	Straight Plug	TC-400-TM	3190-260	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.074	(33.6)
	Straight Plug	EZ-400-TM	3190-650	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.074	(33.6)
	Right Angle	TC-400-TM-RA	3190-442	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.7	(43)	0.59	(15.0)	0.085	(38.6)
	Reverse Polarity	TC-400-TM-RP	3190-1062	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.7	(43)	0.59	(15.0)	0.074	(33.6)
	Reverse Polarity	EZ-400-TM-RP	3190-794	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	1.7	(43)	0.59	(15.0)	0.074	(33.6)
UHF Male	Straight Plug	EZ-400-UM	3190-997	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/G	1.9	(48)	0.80	(20.3)	0.090	(40.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


EZ-400-NF


EZ-400-NF-BH


TC-400-NFC-BH (A)

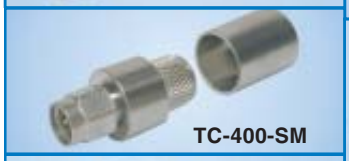

TC-400-TM


EZ-400-TM


TC-400-TM-RA


TC-400-TM-RP
EZ-400-TM-RP


TC-400-TF-RP
EZ-400-TF-RP


TC-400-SM


TC-400-BM


TC-400-MUHF


EZ-400-UM


TC-400-716MC


TC-400-716FC


TC-400-HNM


TC-400-QDSM


GK-S400TT


HG-400T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400TT	GK-S400TT	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)


CR-400


ST-400C-2


HX-4


CT-400/300


Y1719


RB-456


CCT-01


ST-400C


ST-400EZ


DBT-01

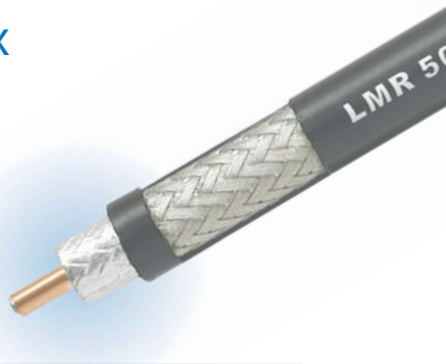

TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	Prep tool for all LMR clamp style connectors except EZ-400-NMC-2
Strip Tool	ST-400C-2	3190-1972	Prep tool for EZ-400-NMC-2 two piece clamp style connector
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Replacement Blades	RB-456	3190-421	Replacement blades for Strip Tool
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

LMR®-500
Flexible Low Loss Communications Coax



Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-500 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-500. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-500 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for LMR-500 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-500 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-500	Outdoor	PE	Black	54002
LMR-500-DB	Outdoor/Watertight	PE	Black	54092
LMR-500-FR	Indoor -Riser CMR	FRPE	Black	54031

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.142	(3.61)
Dielectric	Foam PE	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	(see table above)	0.500	(12.70)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.097	(0.14)
Tensile Strength	lb (kg)	260	(118.0)
Flat Plate Crush	lb/in. (kg/mm)	50	(0.89)

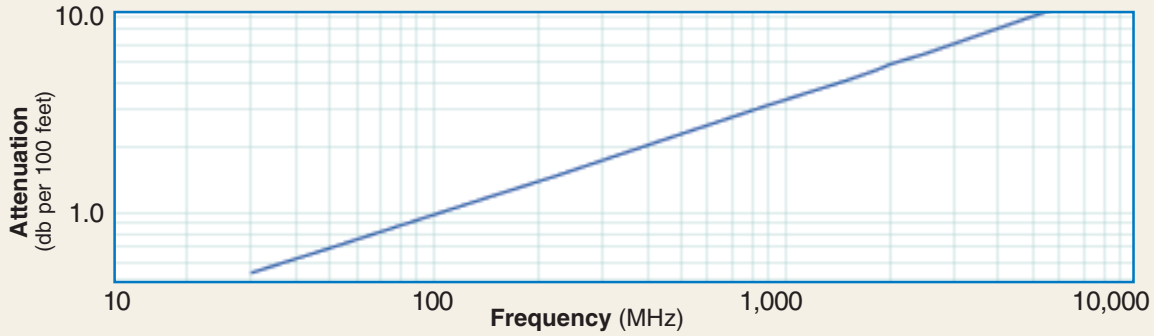
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+85	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

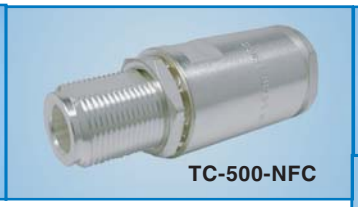
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	12.6	
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.88)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.6	(77.5)
Inductance	uH/ft (uH/m)	0.059	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.82	(2.7)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	22	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.5	0.7	1.2	1.5	2.2	3.1	4.1	4.6	4.8	5.5	8.9
Attenuation dB/100 m	1.8	2.3	4.0	4.9	7.1	10.3	13.6	15.0	15.9	18.0	29.1
Avg. Power kW	4.400	3.393	1.931	1.583	1.088	0.752	0.569	0.515	0.485	0.428	0.264

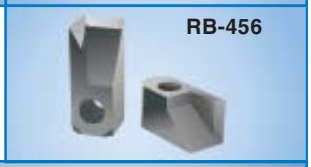
Calculate Attenuation = (0.096590) • $\sqrt{\text{FMHz}}$ + (0.000260) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Female	Straight Jack	TC-500-NFC	3190-215	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9)	0.215 (97.5)
	Bulkhead Kit	BHA-KIT	3190-223	<1.25:1 (2.5)	NA	NA	NA	NA	NA NA	NA NA	0.014 (6.4)
N Male	Straight Plug	TC-500-NMC	3190-377	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228(103.4)
	Right Angle	TC-500-NMC-RA	3190-227	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.4 (61)	1.5 (38.1)	0.275(124.7)
TNC Male	Straight Plug	TC-500-TM	3190-464	<1.25:1 (2.5)	Hex	Solder	Crimp	N/G	1.5 (38)	0.62 (15.7)	0.082 (28.1)
UHF Male	Straight Plug	TC-500-UMC	3190-354	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	2.1 (53)	0.88 (22.4)	0.215 (97.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Replacement Blades	RB-456	3190-421	Replacement Blades for Strip Tools
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-600
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **LMR®- FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®- PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®- PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-600 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for LMR-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part Number	**Application**	**Jacket**	**Color**	**Stock Code**
LMR-600	Outdoor	PE	Black	54003
LMR-600-DB	Outdoor/Watertight	PE	Black	54093
LMR-600-FR	Indoor -Riser CMR	FRPE	Black	54032
LMR-600-FR-PVC	Indoor -Riser CMR	FRPVC	Black	54074
LMR-600-PVC	Indoor/Outdoor	PVC	Black	54219
LMR-600-PVC-W	Indoor/Outdoor	PVC	White	54206

Construction Specifications			
Description	**Material**	**In.**	**(mm)**
Inner Conductor	Solid BCCAl	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	(see table above)	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.131	(0.20)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

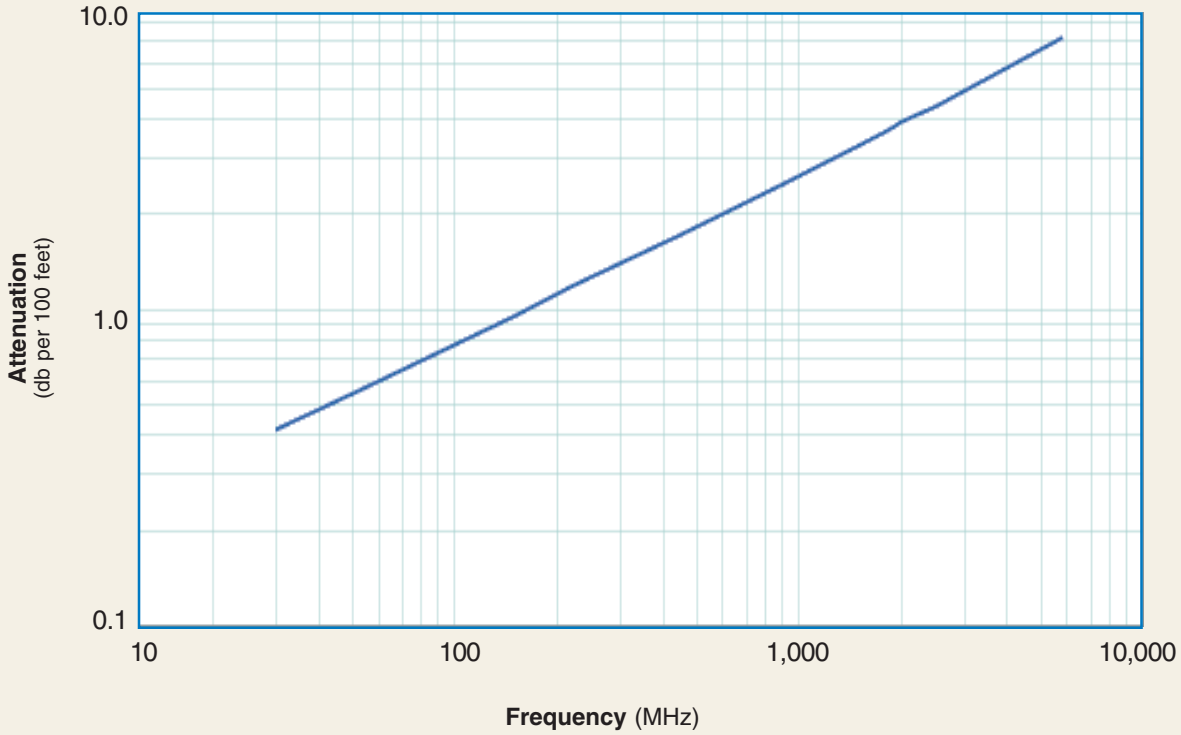
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	10.3	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.53	(1.7)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.4	0.5	1.0	1.2	1.7	2.5	3.3	3.7	3.9	4.4	7.3
Attenuation dB/100 m	1.4	1.8	3.2	3.9	5.6	8.2	10.9	12.1	12.8	14.5	23.8
Avg. Power kW	5.51	4.24	2.41	1.97	1.35	0.93	0.70	0.63	0.59	0.52	0.32

Calculate Attenuation =
$(0.075550) \bullet \sqrt{FMHz} + (0.000260) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-600
Flexible Low Loss Communications Coax

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
7/8 EIA	Flange	EZ-600-78EIA	3190-1373	<1.25:1 (2.5)	NA	Spring Finger	Clamp	S/S	2.3 (58)	2.60 (66.0)	0.873 (396.0)
7-16 DIN Female	Straight Jack	TC-600-716FC	3190-375	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	1.1 (28)	1.00 (25.4)	0.249 (112.9)
7-16 DIN Male	Straight Plug	EZ-600-716MH	3190-503	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/S	2.0 (51)	1.30 (33.0)	0.254 (115.2)
	Straight Plug	TC-600-716MC	3190-502	<1.25:1 (2.5)	Hex	Solder	Clamp	S/S	2.0 (51)	1.30 (33.0)	0.347 (157.4)
	Right Angle	TC-600-716M-RA	3190-395	<1.35:1 (2.5)	Hex	Solder	Crimp	S/S	1.4 (36)	1.40 (35.6)	0.354 (160.8)
HN Male	Straight Plug	TC-600-HNM	3190-1429	<1.25:1 (<1)	Knurl	Solder	Clamp	S/g	2.3 (59.2)	0.88 (22.4)	0.25 (113)
LC Male	Straight Plug	TC-600-LCM	3190-1406	<1.25:1 (<1)	Hex	Solder	Clamp	N/S	3.1 (78.0)	1.62 (41.1)	1.20 (544)
N Female	Straight Jack	EZ-600-NF	3190-955	<1.25:1 (2.5)	NA	Spring Finger	Crimp	S/G	2.3 (59)	0.87 (22.1)	0.150 (68.0)
	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (2.5)	NA	Spring Finger	Crimp	S/G	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1 (2.5)	NA	Solder	Crimp	S/G	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9)	0.214 (97.1)
N Male	Straight Plug	EZ-600-NMH-D	3190-1268	<1.25:1 (8)	Hex/Knurl	Spring Finger	Crimp	A/G	2.1 (53)	0.92 (23.4)	0.164 (74.4)
	Straight Plug	EZ-600-NMK	3190-669	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.164 (74.4)
	Straight Plug	TC-600-NMH-D	3190-208	<1.25:1 (2.5)	Hex/Knurl	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166 (75.3)
	Straight Plug	EZ-600-NMC-2	3190-1387	<1.25:1 (6)	Hex/Knurl	Spring Finger	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.202 (91.6)
	Straight Plug	TC-600-NMC	3190-357	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.280 (117.9)
	Right Angle	EZ-600-NMH-RA	3190-762	<1.35:1 (2.5)	Hex	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.185 (83.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.185 (83.9)
QDS Male	Straight Plug	TC-600-QDSM	3190-846	<1.25:1 (<1)	Knurl	Solder	Clamp	A/G	2.2 (55.6)	1.00 (25.4)	0.25 (113)
	Right Angle	TC-600-QDSM-RA	3190-847	<1.25:1 (<1)	Knurl	Solder	Clamp	A/G	2.4 (61.5)	1.88 (47.8)	0.35 (159)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	1.7 (43)	0.59 (15.0)	0.112 (50.8)
	Reverse Polarity	EZ-600-TM-RP	3190-796	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	2.2 (56)	0.87 (22.0)	0.112 (50.8)
TNC Female	Reverse Polarity	EZ-600-TF-RP	3190-797	<1.25:1 (2.5)	NA	Spring Finger	Crimp	A/G	2.3 (58)	0.87 (22.0)	0.100 (45.4)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	1.7 (43)	0.88 (22.4)	0.164 (74.4)
	Straight Plug	TC-600-UMC	3190-213	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.88 (22.4)	0.198 (89.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


EZ-600-78EIA


EZ-600-NMK


TC-600-HNM


TC-600-QDSM


TC-600-LCM


TC-600-QDSM-RA


HX-4


ST-600C ST-600EZ


WR-600

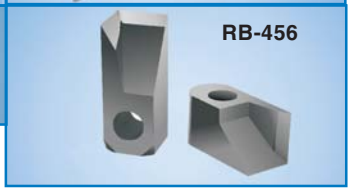

GST-600A


CR-600


CCT-01


DBT-01


Y1720


RB-456

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	ST-600C	3190-230	For Clamp Style Connectors
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Replacement Blades	RB-456	3190-421	Replacement Blades for Strip Tools
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Wrench	WR600	3190-1435	15/16" Box Wrench (2 required for EZ-600-NMC-2)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)


SH-U600T


CB-600T


HG-600T


Hanger Support Hardware


CS-A600T, CS-60120T, CS-60170T


SC-600T


GK-S600TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Stand. Entry Port Cushion	SC-600T	SC-600T-3	Three cables (each)
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available

TIMES MICROWAVE SYSTEMS

LMR®-900
Flexible Low Loss Communications Coax

Ideal for...

- Medium Antenna Feeder runs (no jumpers required)
- Jumper Assemblies for 1-5/8" & 2-1/4" Feeders
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-900 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-900. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-900 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A selection of connectors including type-N, 7/16 DIN, and 7/8 EIA flanges are available for LMR-900. Other interfaces are available on request. Transition to interfaces smaller than type-N is best accomplished with a short jumper cable.

• **Cable Assemblies**: All LMR-900 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part N.	Application	Jacket	Color	Stock Code
LMR-900-DB	Outdoor/Watertight	PE	Black	54094
LMR-900-FR	Indoor -Riser CMR	FRPE	Black	54033

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	BC Tube (.222" ID)	0.262	(6.65)
Dielectric	Foam PE	0.680	(17.27)
Outer Conductor	Aluminum Tape	0.686	(17.42)
Overall Braid	Tinned Copper	0.732	(18.59)
Jacket	(see table above)	0.870	(22.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	3.00	(76.2)
Bend Radius: repeated	in. (mm)	9.0	(228.6)
Bending Moment	ft-lb (N-m)	9.0	(12.20)
Weight	lb/ft (kg/m)	0.266	(0.40)
Tensile Strength	lb (kg)	750	(340.5)
Flat Plate Crush	lb/in. (kg/mm)	100	(1.79)

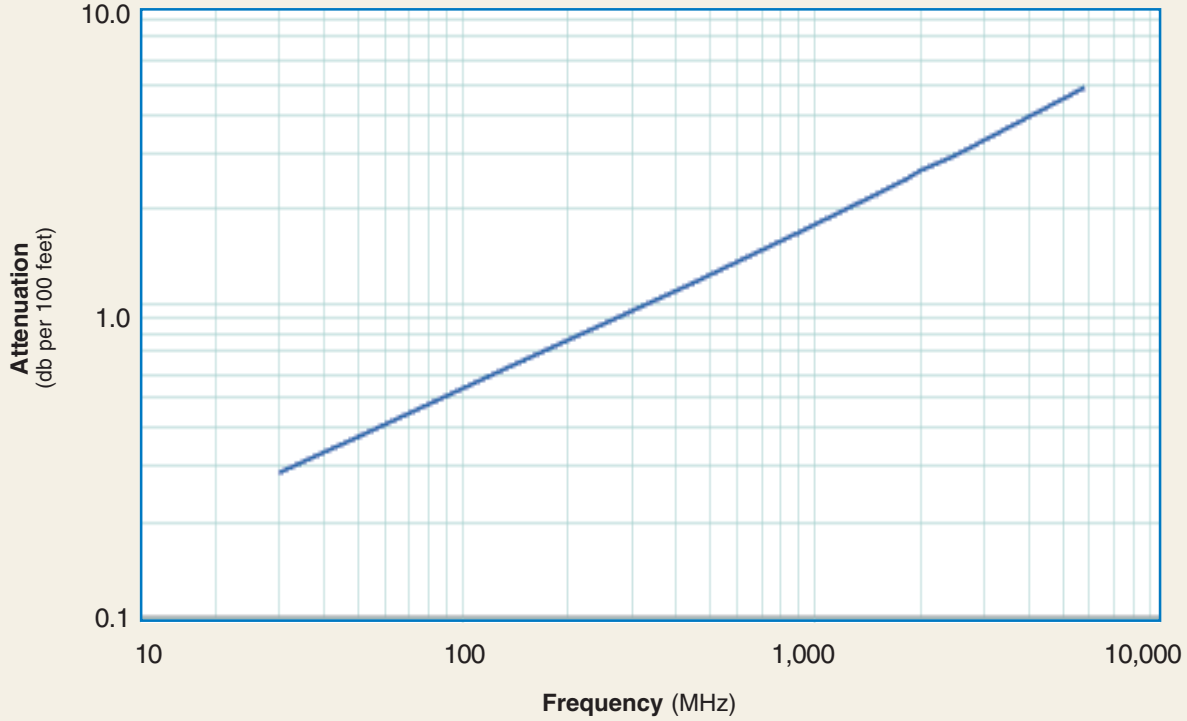
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	6.9	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.54	(1.77)
Outer Conductor	ohms/1000ft (/km)	0.55	(1.8)
Voltage Withstand	Volts DC	5000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	62	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.3	0.4	0.7	0.8	1.2	1.7	2.2	2.5	2.6	3.0	4.9
Attenuation dB/100 m	0.9	1.2	2.2	2.6	3.8	5.6	7.4	8.2	8.6	9.8	16.0
Avg. Power kW	8.89	6.85	3.89	3.19	2.19	1.51	1.14	1.03	0.97	0.86	0.52

Calculate Attenuation =
$(0.051770) \bullet \sqrt{FMHz} + (0.000160) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

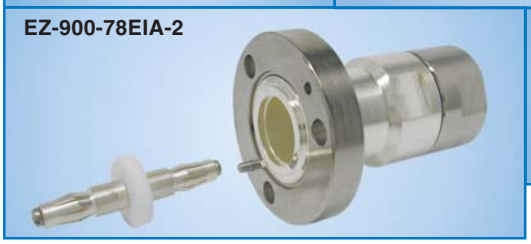
LMR®-900
Flexible Low Loss Communications Coax


EZ-900-716FC


EZ-900-NMC-2


EZ-900-716-MC-RA


EZ-900-NFC-2


EZ-900-78EIA-2


EZ-900-716MC-2


EZ-900-78EIA-RA

Connectors

Interface	Description	Part Number	Stock Code	VSWR ** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
7-16 DIN Female	Straight Jack	EZ-900-716FC	3190-334	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.0 (51)	1.38 (35.1)	0.379 (171.9)
7-16 DIN Male	Straight Plug	EZ-900-716MC-2	3190-1641	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.44 (36.6)	0.485 (220.0)
7-16 DIN Male	Right Angle	EZ-900-716-MC-RA	3190-614	<1.35:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.7 (69)	2.15 (55.0)	1.150 (521.6)
7/8 EIA Male	Straight Plug	EZ-900-78EIA-2	3190-1282	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	3.0 (76)	2.24 (56.9)	1.013 (459.5)
7/8 EIA Male	Right Angle	EZ-900-78EIA-RA	3190-1450	<1.25:1 (1)	Flange	Press Fit	Clamp	S/S	2.95 (75.0)	2.60 (66.0)	1.50 (680.4)
N Female	Straight Jack	EZ-900-NFC-2	3190-1263	<1.25:1 (6)	NA	Press Fit	Clamp	S/S	2.0 (51)	1.38 (35.1)	0.443 (200.9)
N Male	Straight Plug	EZ-900-NMC-2	3190-1262	<1.25:1 (6)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.38 (35.1)	0.463 (210.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


ST-900/1200C


ST-900C


GST-900A


WR-900


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-900C	3190-1310	For LMR 900 Clamp Style Connectors
Midspan Strip Tool	GST-900A	3190-435	For Ground Strap Attachment
Wrenches	WR-900	3190-509	1-1/4" Box Wrench (2 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

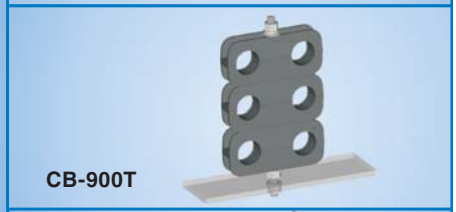

GK-S900T

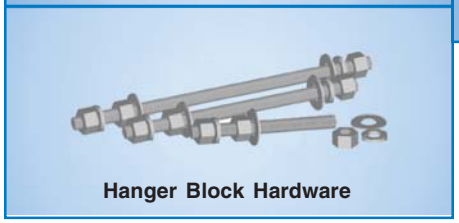

HG-900T


CS-A900T, CS-90120T, CS-90170T


SC-900T


Standard Entry Panels


CB-900T


Hanger Block Hardware


SH-U900T

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S900TT	GK-S900TT	Standard Grounding Kit (each)
Hoisting Grip	HG-900T	HG-900T	Split/Laced Type (each)
Cold Shrink	CS-A900T	CS-A900T	Cable to Antenna Junction (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-90170T	CS-90170T	LMR-900 to -1700 Junction (each)
Stand. Entry Port Cushion	SC-900T	SC-900T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-900T	CB-900T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-in Hangers	SH-U900T	SH-U900T	Snap-in Hanger (Kit of 10)

TIMES MICROWAVE SYSTEMS

LMR®-1200
Flexible Low Loss Communications Coax

Ideal for...

- Medium Antenna Feeder runs
- Jumper Assemblies for 1-5/8" & 2-1/4" Feeders
- Building-Top Sites
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®-DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.
• **LMR®-FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-1200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
• **Low Loss** is another hallmark feature of LMR-1200. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-1200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.
• **Connectors**: A selection of connectors including type-N, 7/16 DIN, and 7/8 EIA flanges are available for LMR-1200. Other interfaces are available on request. Transition to interfaces smaller than type-N is best accomplished with a short jumper cable.
• **Cable Assemblies**: All LMR-1200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-1200-DB	Outdoor/Watertight	PE	Black	54095
LMR-1200-FR	Indoor -Riser CMR	FRPE	Black	54034

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	BC Tube (.309" ID)	0.349	(8.86)
Dielectric	Foam PE	0.920	(23.37)
Outer Conductor	Aluminum Tape	0.926	(23.52)
Overall Braid	Tinned Copper	0.972	(24.69)
Jacket	(see table above)	1.200	(30.48)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	6.50	(165.1)
Bend Radius: repeated	in. (mm)	12.0	(304.8)
Bending Moment	ft-lb (N-m)	15	(20.34)
Weight	lb/ft (kg/m)	0.448	(0.67)
Tensile Strength	lb (kg)	1300	(590.2)
Flat Plate Crush	lb/in. (kg/mm)	250	(4.47)

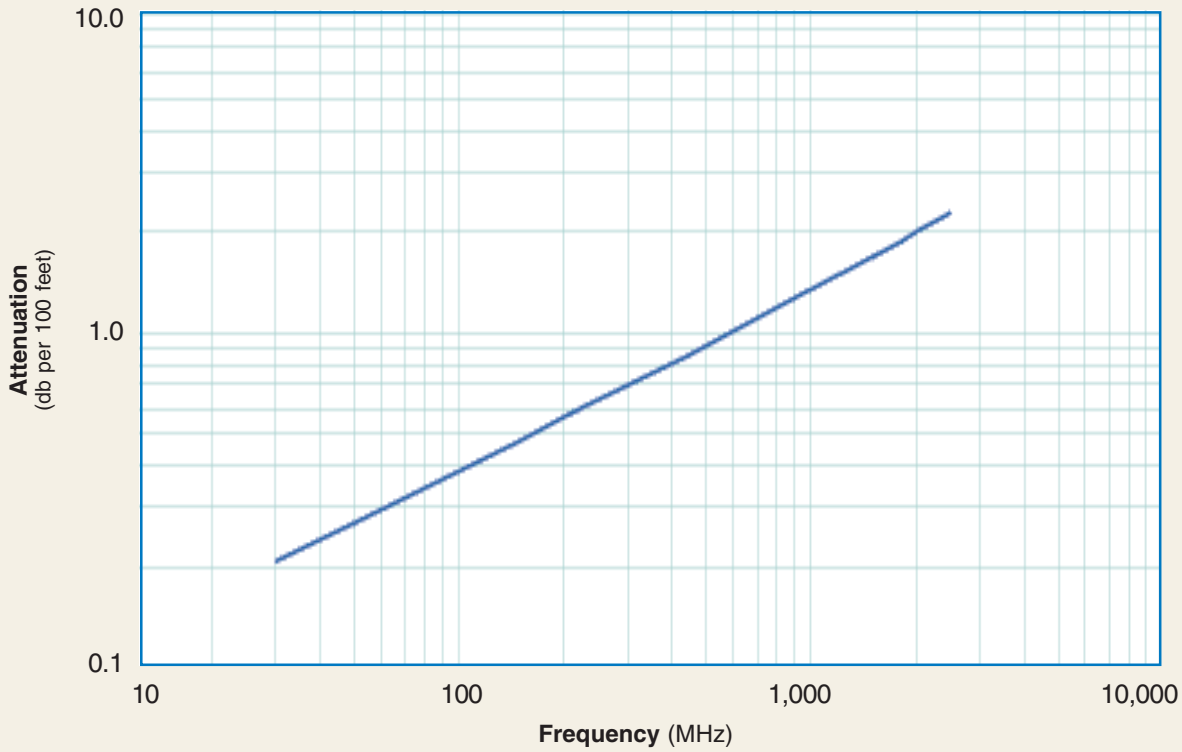
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	5.2	
Velocity of Propagation	%	88	
Dielectric Constant	NA	1.29	
Time Delay	nS/ft (nS/m)	1.15	(3.79)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.1	(75.8)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.32	(1.0)
Outer Conductor	ohms/1000ft (/km)	0.37	(1.2)
Voltage Withstand	Volts DC	6000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	90	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.2	0.3	0.5	0.6	0.9	1.3	1.7	1.9	2.0	2.3
Attenuation dB/100 m	0.7	0.9	1.6	1.9	2.8	4.2	5.5	6.1	6.5	7.4
Avg. Power kW	12.63	9.72	5.54	4.49	3.06	2.09	1.57	1.41	1.33	1.16

Calculate Attenuation =
$(0.037370) \bullet \sqrt{FMHz} + (0.000160) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-1200
Flexible Low Loss Communications Coax


EZ-1200-716-FC


EZ-1200-716MC


EZ-1200-NFC


EZ-1200-NMC


EZ-1200-78EIA

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Female	Straight Jack	EZ-1200-716FC	3190-338	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.0	(51)	1.65	(41.9)	0.586	(265.8)
7-16 DIN Male	Straight Plug	EZ-1200-716MC	3190-337	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.0	(51)	1.65	(41.9)	0.648	(293.9)
7/8 EIA	Straight Plug	EZ-1200-78EIA	3190-1458	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	3.2	(80)	2.25	(57.2)	1.208	(547.0)
N Female	Straight Jack	EZ-1200-NFC	3190-336	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.0	(51)	1.65	(41.9)	0.650	(294.8)
N Male	Straight Plug	EZ-1200-NMC	3190-335	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.0	(51)	1.65	(41.9)	0.659	(298.9)

* Finishes: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


ST-900/1200C


ST-1200C

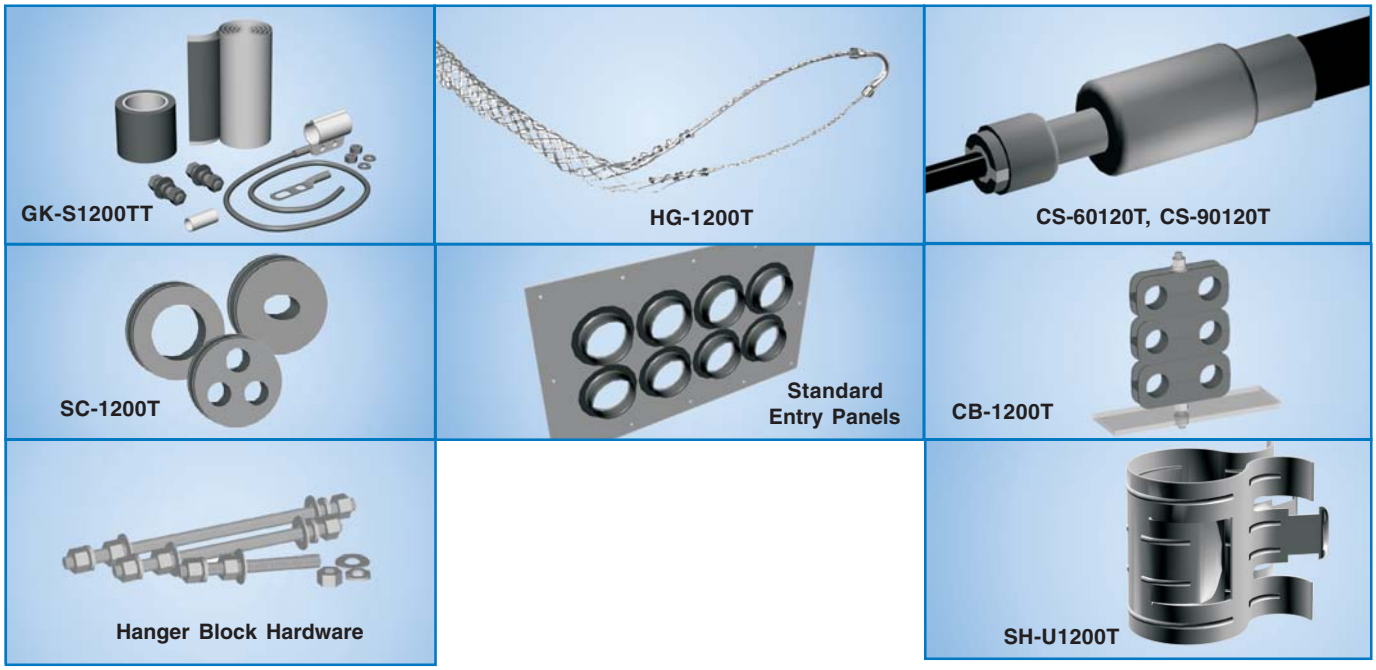

CCT-01


GST-1200A


WR-1200A
WR-1200B

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-1200C	3190-1311	For LMR 1200 Clamp Style Connectors
Midspan Strip Tool	GST-1200A	3190-436	For Ground Strap Attachment
Wrench	WR-1200A	3190-512	1-9/16" Box Wrench (1 required)
Wrench	WR-1200B	3190-511	1-7/16" Box Wrench Pair (1 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S1200TT	GK-S1200TT	Standard Grounding Kit (each)
Hoisting Grip	HG-1200T	HG-1200T	Split/Laced Type (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Standard Entry Port Cushion	SC-1200T	SC-1200T	Three Cables (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-1200T	CB-1200T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		
Snap-In Hangers	SH-U1200T	SH-U1200T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

LMR®-1700
Flexible Low Loss Communications Coax

Ideal for...

- Long Antenna Feeder runs
- Building-Top Sites
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR®- DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.
• **LMR®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-1700 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
• **Low Loss** is another hallmark feature of LMR-1700. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
• **Weatherability**: LMR-1700 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A selection of connectors including type-N, 7/16 DIN, and 7/8 EIA flanges are available for LMR-1700. Other interfaces are available on request. Transition to interfaces smaller than type-N is best accomplished with a short jumper cable.
• **Cable Assemblies**: All LMR-1700 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-1700-DB	Outdoor/Watertight	PE	Black	54096
LMR-1700-FR	Indoor -Riser CMR	FRPE	Black	54035

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	BC Tube (.477" ID)	0.527	(13.39)
Dielectric	Foam PE	1.350	(34.29)
Outer Conductor	Aluminum Tape	1.356	(34.44)
Overall Braid	Tinned Copper	1.402	(35.61)
Jacket	(see table above)	1.670	(42.42)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	13.50	(342.9)
Bend Radius: repeated	in. (mm)	17.0	(431.8)
Bending Moment	ft-lb (N-m)	40	(54.23)
Weight	lb/ft (kg/m)	0.736	(1.10)
Tensile Strength	lb (kg)	1500	(681.0)
Flat Plate Crush	lb/in. (kg/mm)	300	(5.36)

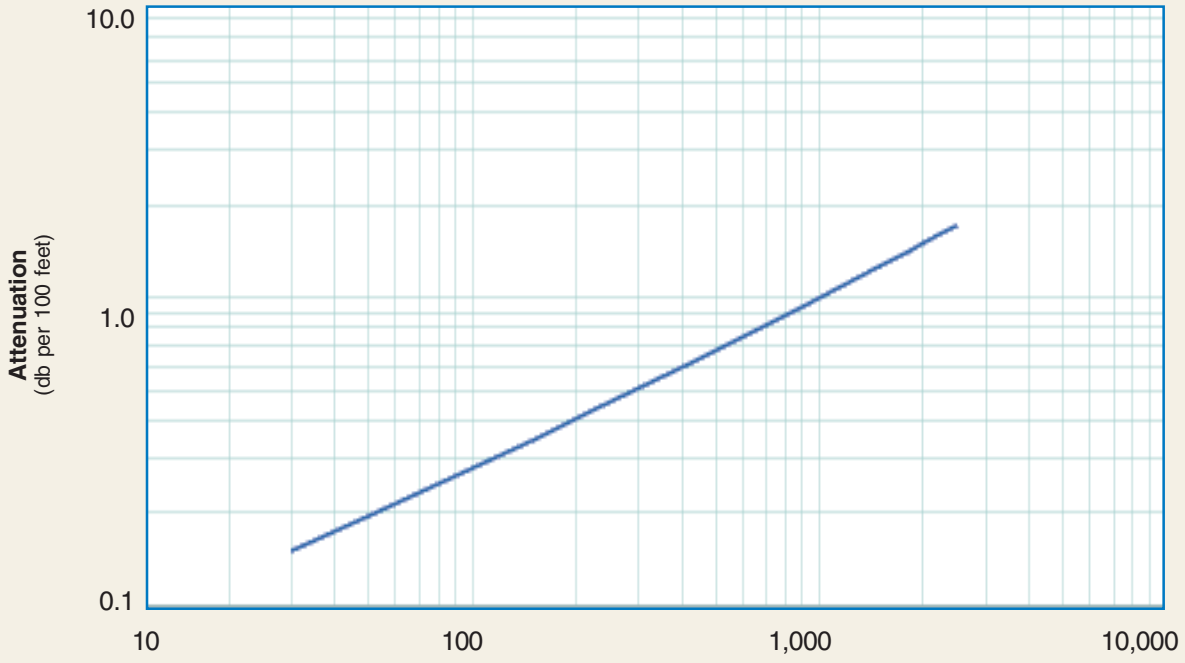
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	3.6	
Velocity of Propagation	%	89	
Dielectric Constant	NA	1.26	
Time Delay	nS/ft (nS/m)	1.14	(3.75)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	22.8	(74.9)
Inductance	uH/ft (uH/m)	0.057	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.21	(0.7)
Outer Conductor	ohms/1000ft (/km)	0.27	(0.9)
Voltage Withstand	Volts DC	9000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	202	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.1	0.2	0.3	0.4	0.6	0.9	1.3	1.4	1.5	1.7
Attenuation dB/100 m	0.5	0.6	1.1	1.4	2.1	3.1	4.1	4.6	4.9	5.7
Avg. Power kW	20.27	15.55	8.72	7.09	4.79	3.23	2.40	2.15	2.02	1.76

Calculate Attenuation =
$(0.026460) \bullet \sqrt{FMHz} + (0.000160) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-1700 Flexible Low Loss Communications Coax


EZ-1700-716FC


EZ-1700-716MC


EZ-1700-NFC


EZ-1700-NMC

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
7-16 DIN Female	Straight Jack	EZ-1700-716FC	3190-388	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.005(455.9)
7-16 DIN Male	Straight Plug	EZ-1700-716MC	3190-387	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.055(478.5)
N Female	Straight Jack	EZ-1700-NFC	3190-386	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.087(493.1)
N Male	Straight Plug	EZ-1700-NMC	3190-385	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.058(479.9)

* Finishes: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


ST-1700C

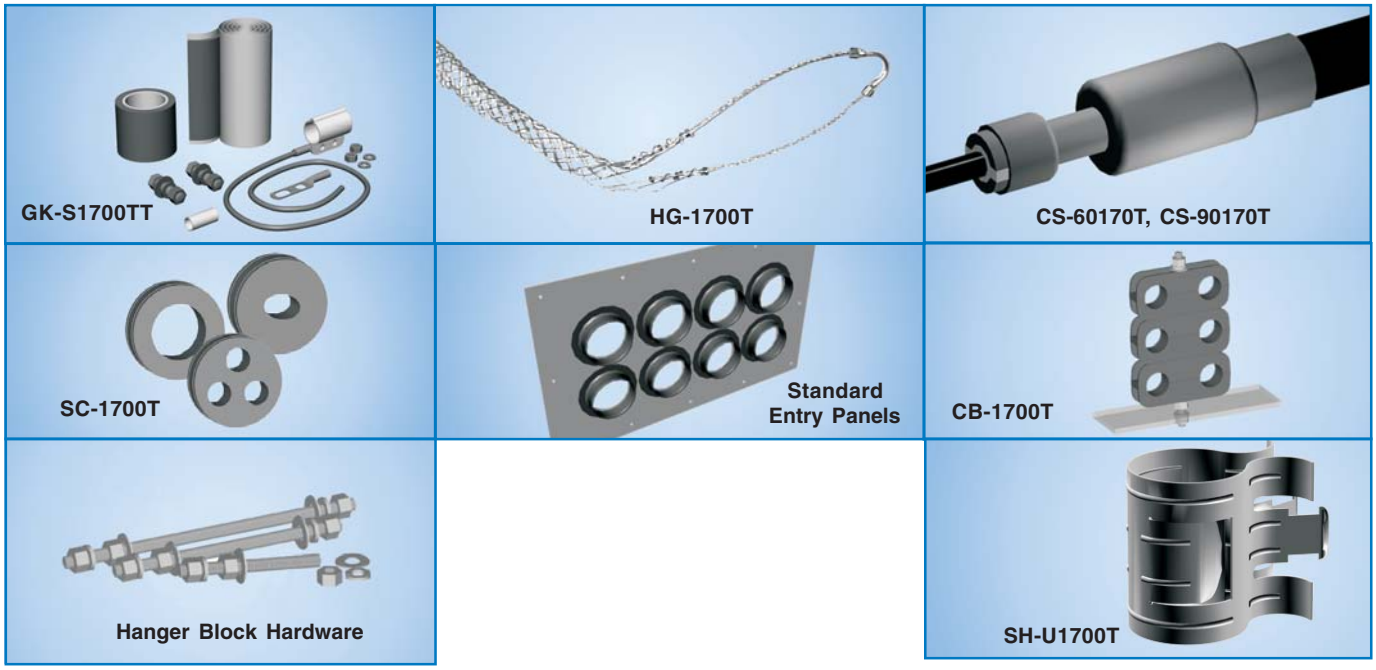

WR-1700


GST-1700A


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-1700C	3190-312	For Clamp Style Connectors
Midspan Strip Tool	GST-1700A	3190-437	For Ground Strap Attachment
Wrenches	WR-1700	3190-514	2" Box Wrench (2 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S1700TT	GK-S1700TT	Standard Grounding Kit (each)
Hoisting Grip	HG-1700T	HG-1700T	Split/Laced Type (each)
Cold Shrink	CS-90170T	CS-90170T	LMR-900 to -1700 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Standard Entry Port Cushion	SC-1700T	SC-1700T	One Cable (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-1700T	CB-1700T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		
Snap-In Hangers	SH-U1700T	SH-U1700T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

LMR® lite-195
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable
- Drop-in replacement for RG-58 and RG-142

• **LMR-LW195** is a lightweight low loss coaxial cable that employs an aluminum braid shield instead of the traditional tinned copper shield. LMR-LW195 has been designed and engineered with a combination of electrical, physical and mechanical properties that reduce weight and cost.

• **Flexibility** and bendability that are hallmarks of LMR-195 are also the same for LMR-LW195. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

•**Low Loss** is another hallmark feature of LMR-LW195. Size for size LMR® has the lowest loss of any flexible cable and comparable loss to semi rigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-LW195 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: LMR-LW195 uses the same connectors, tools and installation accessories as standard LMR®. A wide variety of connectors are available for LMR-LW195 including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-LW195 cable types are available as pre-terminated cable assemblies.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-LW-195	Outdoor	PE	Black	45110

PE = Polyethylene

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Foam PE	0.110	(2.79)
Outer Conductor	Aluminum Tape	0.116	(2.95)
Overall Braid	Aluminum	0.139	(3.53)
Jacket	(See table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	.015	(0.048)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

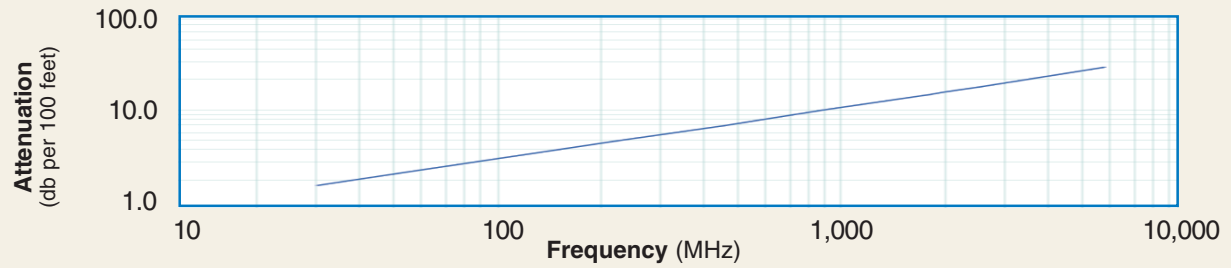
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	25.4	(83.3)
Inductance	uH/ft (uH/m)	0.064	(0.21)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.6	(24.9)
Outer Conductor	ohms/1000ft (/km)	18.1	(59.4)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.0	2.5	4.4	5.4	7.8	11.1	14.5	16.0	16.9	19.0	29.9
Attenuation dB/100 m	6.5	8.4	14.6	17.7	25.5	36.5	47.7	52.5	55.4	62.4	98.1
Avg. Power kW	0.89	0.68	0.39	0.32	0.22	0.16	0.12	0.11	0.10	0.09	0.06

Calculate Attenuation = (0.356859) • $\sqrt{\text{FMHz}}$ + (0.000470) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-195-NM


TC-195-SM


TC-195-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100,195, 200 and 240connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CT-240/200/195/100


CCT-01

TIMES MICROWAVE SYSTEMS

LMR® lite-200
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR-LW200** is a lightweight low loss coaxial cable that employs an aluminum braid shield instead of the traditional tinned copper shield. LMR-LW200 has been designed and engineered with a combination of electrical, physical and mechanical properties that reduce weight and cost.

• **Flexibility** and bendability that are hallmarks of LMR-200 are also the same for LMR-LW200. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

•**Low Loss** is another hallmark feature of LMR-LW200. Size for size LMR® has the lowest loss of any flexible cable and comparable loss to semi rigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-LW200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: LMR-LW200 uses the same connectors, tools and installation accessories as standard LMR®. A wide variety of connectors are available for LMR-LW200 including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-LW200 cable types are available as pre-terminated cable assemblies.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-LW-200	Outdoor	PE	Black	45022

PE = Polyethylene

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Aluminum	0.144	(3.66)
Jacket	(See table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	.015	(.048)
Tensile Strength	lb (kg)	40	(48)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

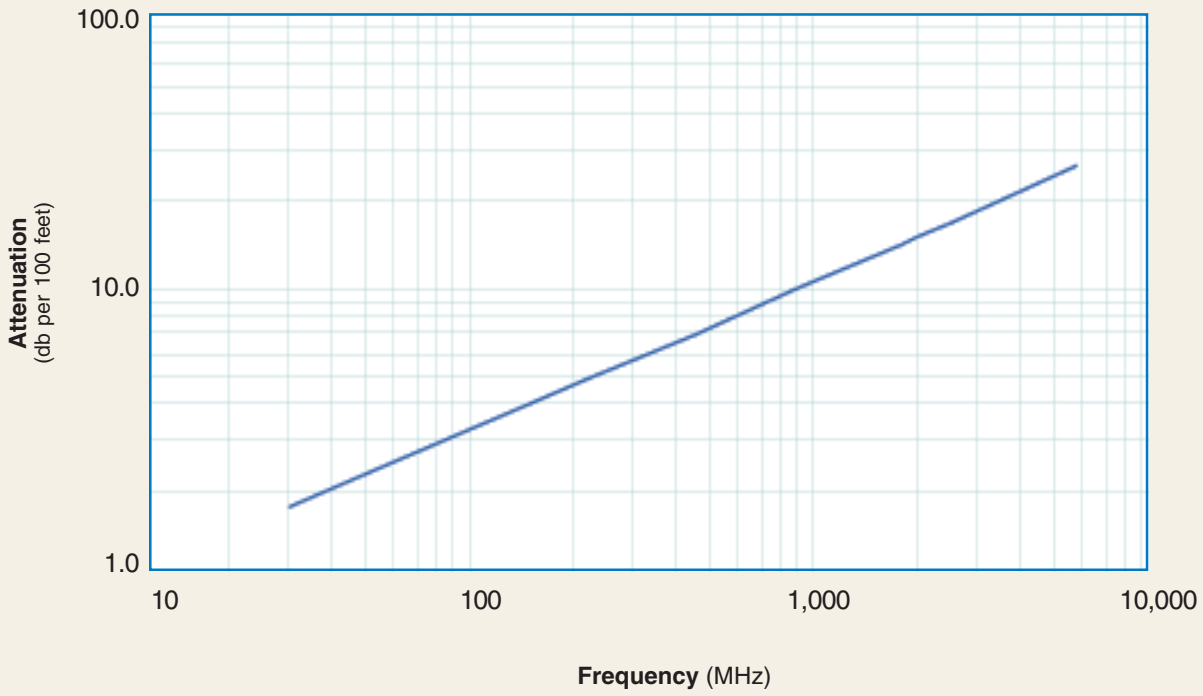
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	18.1	(59.4)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.8	2.3	4.0	4.8	7.0	9.9	12.9	14.2	15.0	16.9	26.4
Attenuation dB/100 m	5.8	7.5	13.1	15.9	22.8	32.6	42.4	46.6	49.3	55.4	86.5
Avg. Power kW	1.02	0.79	0.45	0.37	0.26	0.18	0.14	0.13	0.12	0.11	0.07

Calculate Attenuation =
$(0.320900) \bullet \sqrt{FMHz} + (0.000330) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR® lite-240
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs (e.g. WLL, GPS, LMR, Mobile Antennas)
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR-LW240** is a lightweight low loss coaxial cable that employs an aluminum braid shield instead of the traditional tinned copper shield. LMR-LW240 has been designed and engineered with a combination of electrical, physical and mechanical properties that reduce weight and cost.

• **Flexibility** and bendability that are hallmarks of LMR-240 are also the same for LMR-LW240. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
•**Low Loss** is another hallmark feature of LMR-LW240. Size for size LMR® has the lowest loss of any flexible cable and comparable loss to semi rigid hard-line cables.
• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
• **Weatherability**: LMR-LW240 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.
• **Connectors**: LMR-LW240 uses the same connectors, tools and installation accessories as standard LMR®. A wide variety of connectors are available for LMR-LW240 including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.
• **Cable Assemblies**: All LMR-LW240 cable types are available as pre-terminated cable assemblies.

Part Description				Stock
Part Number	Application	Jacket	Color	Code
LMR-LW-240	Outdoor	PE	Black	45021

PE = Polyethylene

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.056	(1.42)
Dielectric	Foam PE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Aluminum	0.178	(4.52)
Jacket	(See table above)	0.240	(6.10)

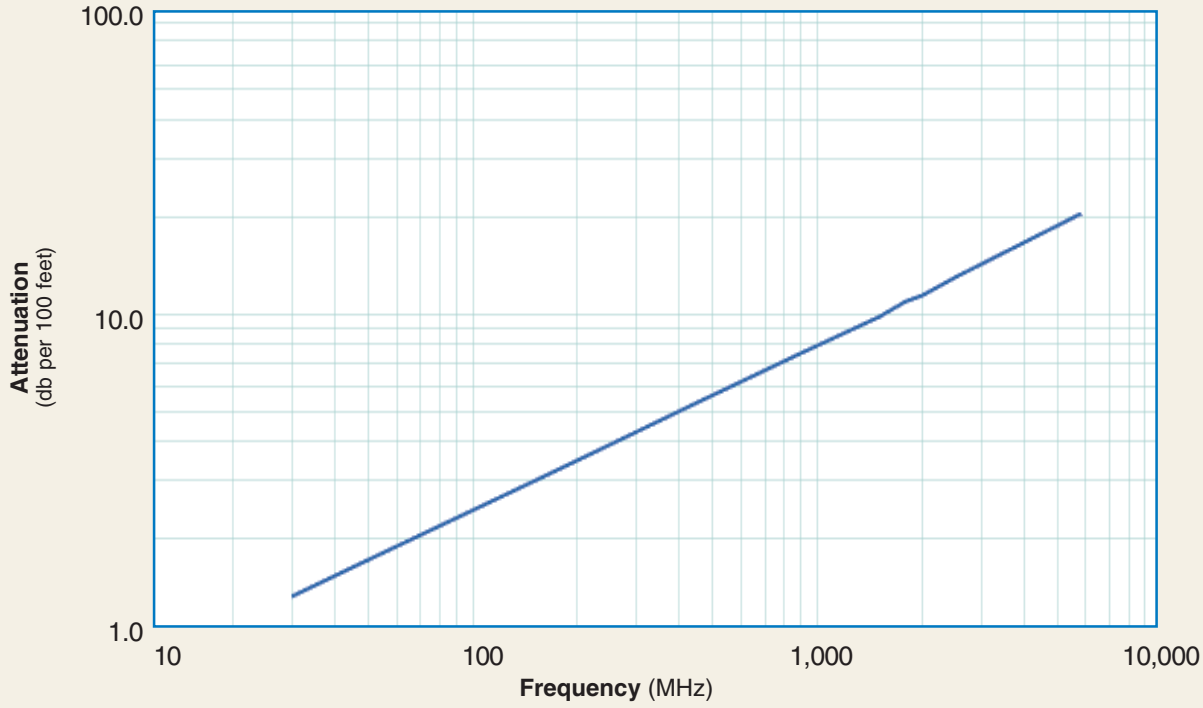
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.85)
Weight	lb/ft (kg/m)	.026	(0.085)
Tensile Strength	lb (kg)	80	(36.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

Environmental Specifications		
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	31	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	3.2	(10.5)
Outer Conductor	ohms/1000ft (/km)	14.4	(47.2)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.3	1.7	3.0	3.7	5.3	7.6	9.9	10.9	11.5	12.9	20.4
Attenuation dB/100 m	4.4	5.7	9.9	12.0	17.3	24.8	32.4	35.6	37.7	42.4	66.8
Avg. Power kW	1.49	1.15	0.66	0.54	0.38	0.26	0.20	0.18	0.17	0.15	0.10

Calculate Attenuation =
(0.242080) • $\sqrt{}$FMHz + (0.000330) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)
Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR lite®-400
Flexible Low Loss Communications Coax

Ideal for...

- Drop-in replacement for RG-8/9913 Air-Dielectric type Cable
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR-LW400** is a lightweight low loss coaxial cable that employs an aluminum braid shield instead of the traditional tinned copper shield. LMR-LW400 has been designed and engineered with a combination of electrical, physical and mechanical properties that reduce weight and cost.

• **Flexibility** and bendability that are hallmarks of LMR-400 are also the same for LMR-LW400. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

•**Low Loss** is another hallmark feature of LMR-LW400. Size for size LMR® has the lowest loss of any flexible cable and comparable loss to semi rigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-LW400 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: LMR-LW400 uses the same connectors, tools and installation accessories as standard LMR®. A wide variety of connectors are available for LMR-LW400 including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-LW400 cable types are available as pre-terminated cable assemblies.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-LW-400	Outdoor	PE	Black	45001

PE = Polyethylene

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.108	(2.74)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Aluminum	0.320	(8.13)
Jacket	(See table above)	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.00	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.50)
Weight	lb/ft (kg/m)	.050	(0.165)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

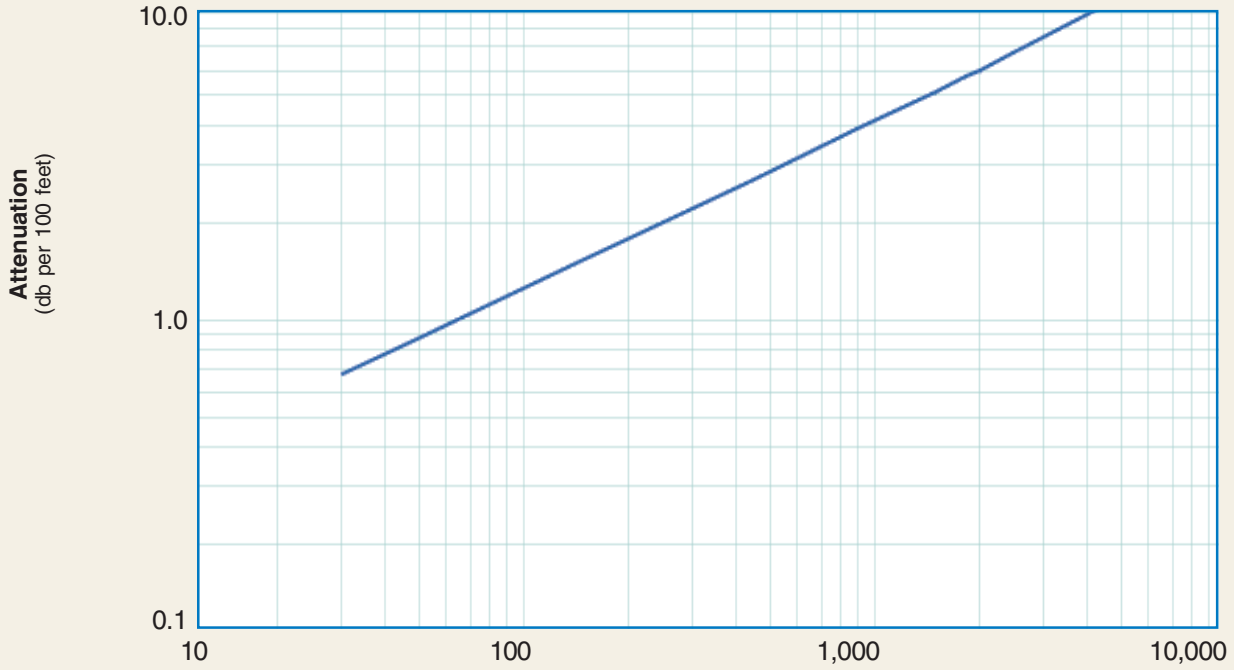
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	16.2	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.6)
Outer Conductor	ohms/1000ft (/km)	6.1	(20.0)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.7	0.9	1.5	1.9	2.7	3.9	5.1	5.7	6.0	6.8	10.8
Attenuation dB/100 m	2.2	2.9	5.0	6.1	8.9	12.8	16.8	18.6	19.6	22.2	35.5
Avg. Power kW	3.33	2.57	1.47	1.20	0.83	0.58	0.44	0.40	0.37	0.33	0.21

Calculate Attenuation =
$(0.122290) \bullet \sqrt{FMHz} + (0.000260) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR® lite-600
Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable

• **LMR-LW600** is a lightweight low loss coaxial cable that employs an aluminum braid shield instead of the traditional tinned copper shield. LMR-LW600 has been designed and engineered with a combination of electrical, physical and mechanical properties that reduce weight and cost.

• **Flexibility** and bendability that are hallmarks of LMR-600 are also the same for LMR-LW600. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

•**Low Loss** is another hallmark feature of LMR-LW600. Size for size LMR® has the lowest loss of any flexible cable and comparable loss to semi rigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-LW600 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: LMR-LW600 uses the same connectors, tools and installation accessories as standard LMR®. A wide variety of connectors are available for LMR-LW600 including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-LW600 cable types are available as pre-terminated cable assemblies.

Part Description				
Part Number	**Application**	**Jacket**	**Color**	**Stock Code**
LMR-600	Outdoor	PE	Black	45003

PE = Polyethylene

Construction Specifications			
Description	**Material**	**In.**	**(mm)**
Inner Conductor	Solid BCCAl	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Aluminum	0.490	(12.45)
Jacket	(see table above)	0.590	(14.99)

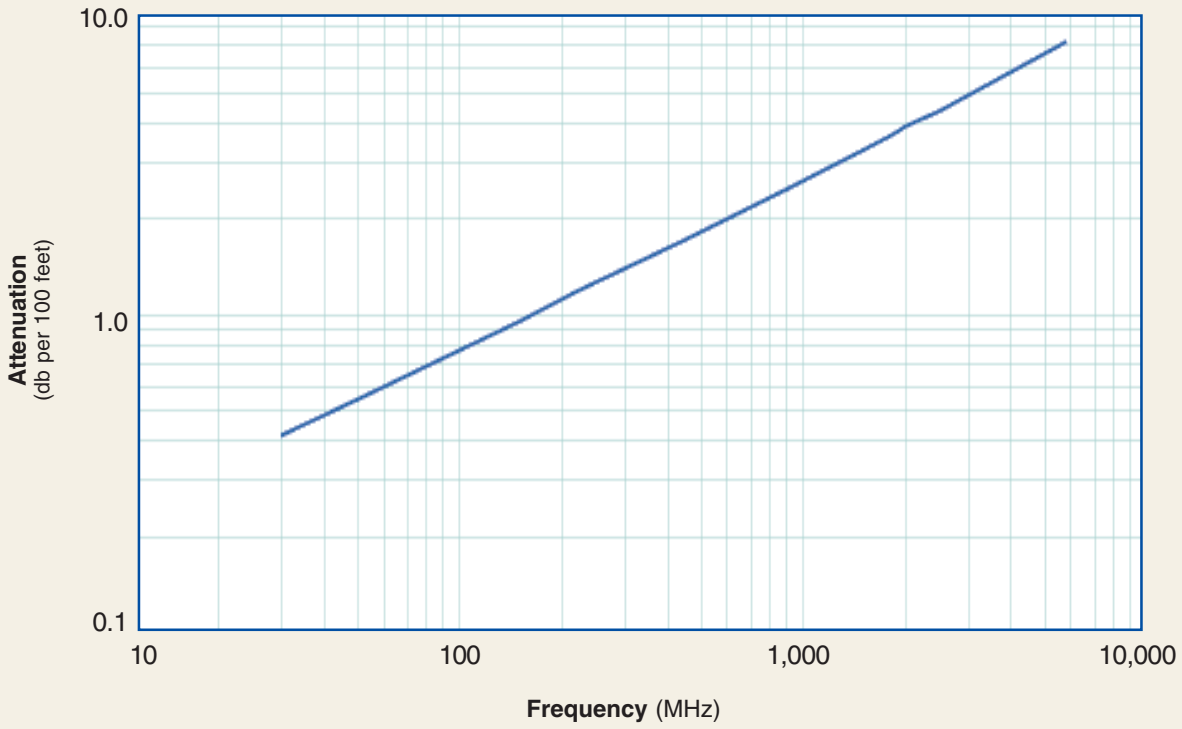
Mechanical Specifications			
Performance Property	**Units**	**US**	**(metric)**
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	.099	(.325)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

Environmental Specifications		
Performance Property	**°F**	**°C**
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	10.3	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.53	(1.7)
Outer Conductor	ohms/1000ft (/km)	4.4	(14.8)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.4	0.5	1.0	1.2	1.7	2.5	3.3	3.7	3.9	4.4	7.3
Attenuation dB/100 m	1.4	1.8	3.2	3.9	5.6	8.2	10.9	12.1	12.8	14.5	23.8
Avg. Power kW	5.51	4.24	2.41	1.97	1.35	0.93	0.70	0.63	0.59	0.52	0.32

Calculate Attenuation =
$(0.075550) \bullet \sqrt{FMHz} + (0.000260) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-195-UF
UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing

• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-195-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-195-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-195-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-195-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-195-UF	Indoor/Outdoor	TPE	Black	54212

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.038	(0.97)
Dielectric	Foam Polyethylene	0.110	(2.79)
Outer Conductor	Aluminum Tape	0.116	(2.95)
Overall Braid	Tinned Copper	0.139	(3.53)
Jacket	Black Thermoplastic Elastomer	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.01	(0.14)
Weight	lb/ft (kg/m)	0.021	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

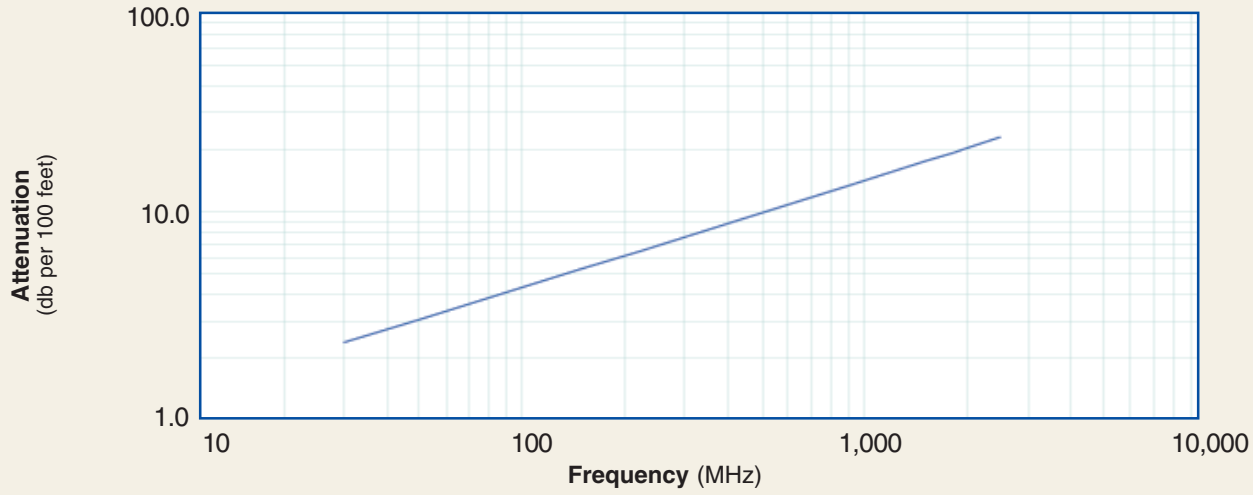
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	16.9	(55.4)
Inductance	uH/ft (uH/m)	0.095	(0.31)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	9.5	(31.2)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.3	3.0	5.3	6.4	9.3	13.2	17.3	19.0	20.1	22.6	35.6
Attenuation dB/100 m	7.7	9.9	17.3	21.1	30.4	43.4	567.7	62.4	65.9	74.2	116.7
Avg. Power kW	0.78	0.61	0.35	0.28	0.20	0.14	0.10	0.09	0.09	0.08	0.05

Calculate Attenuation = (0.424232) • $\sqrt{\text{FMHz}}$ + (0.000563) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lbs (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


CT-240/200/195/100

Install Tools


CCT-01

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-200-UF
UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing

• **LMR®- UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-200-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-200-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR-200-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-200-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-200-UF	Indoor/Outdoor	TPE	Black	54042

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.044	(1.12)
Dielectric	Foam Polyethylene	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Tinned Copper	0.144	(3.66)
Jacket	Black Thermoplastic Elastomer	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.022	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

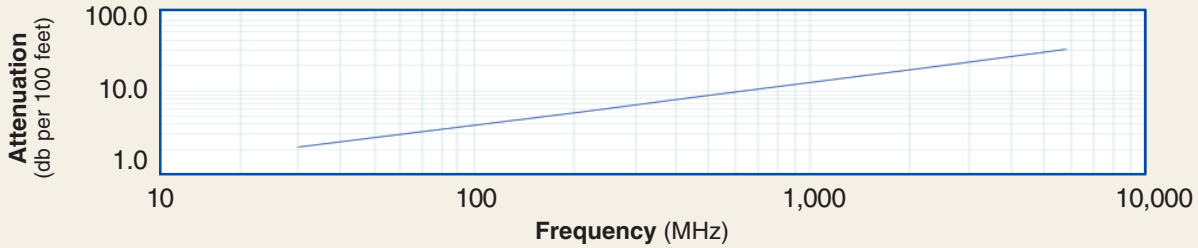
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.5	(24.6)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.1	2.7	4.8	5.8	8.3	11.9	15.5	17.1	18.0	20.2	31.6
Attenuation dB/100 m	7.0	9.0	15.7	19.0	27.4	39.1	50.9	55.9	59.1	66.4	103.8
Avg. Power kW	0.95	0.73	0.42	0.35	0.24	0.17	0.13	0.12	0.11	0.10	0.06

Calculate Attenuation = (0.385082) • $\sqrt{\text{FMHz}}$ + (0.000396) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading


TC-200-BM


TC-200-MUHF


TC-200-NM


TC-200-SM


TC-200-SM-RP


TC-200-TMC


TC-200-TF

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
BNC male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045(20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)
N male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
SMA male	Straight Plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045(20.4)
TNC female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.3 (33.0)	0.57 (14.5)	0.033(15.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200TT	GK-S200TT	Standard Ground Kit (each)


GK-S200TT


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CT-240/200/195/100

TIMES MICROWAVE SYSTEMS

LMR®-240-UF
UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs (e.g. WLL, GPS, LMR, Mobile Antennas)
- Any application that requires periodic/repeated flexing

• **LMR®- UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-240-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-240-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR-240-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-240-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-240-UF	Indoor/Outdoor	TPE	Black	54041

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.056	(1.42)
Dielectric	Foam Polyethylene	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	Black Thermoplastic Elastomer	0.240	(6.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.125	(0.17)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile Strength	lb (kg)	80	(36.3)
Flat Plate Crush	lb/in. (kg/mm)	13	(0.23)

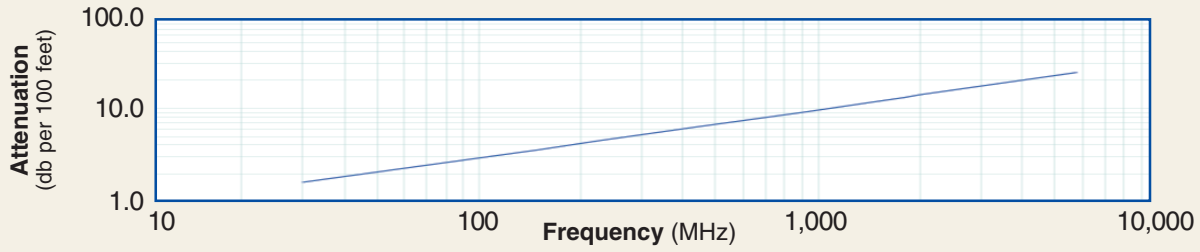
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	31	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	4.28	(14.1)
Outer Conductor	ohms/1000ft (/km)	3.89	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.6	2.1	3.6	4.4	6.3	9.1	11.8	13.0	13.8	15.5	24.4
Attenuation dB/100 m	5.3	6.8	11.9	14.4	20.8	29.8	38.9	42.8	45.2	50.9	80.1
Avg. Power kW	1.24	0.96	0.55	0.45	0.31	0.22	0.17	0.15	0.14	0.13	0.08

Calculate Attenuation = (0.290501) • $\sqrt{\text{FMHz}}$ + (0.000396) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43)	0.56	(14.2)	0.040	(18.1)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.45	(11.4)	0.014	(6.4)
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7	(44)	0.88	(22.2)	0.115	(52.2)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	N/S	1.5	(38)	0.75	(19.1)	0.086	(39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5	(38)	0.75	(19.1)	0.082	(37.2)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.043	(19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (6)	Knurl	Solder	Crimp	N/G	1.3	(33)	0.57	(14.5)	0.055	(24.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240TT	GK-S240TT	Standard Ground Kit (each)

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-300-UF
UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing

• **LMR®- UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-300-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-300-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR-300-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-300-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.070	(1.78)
Dielectric	Foam Polyethylene	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Black Thermoplastic Elastomer	0.300	(7.62)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.88	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

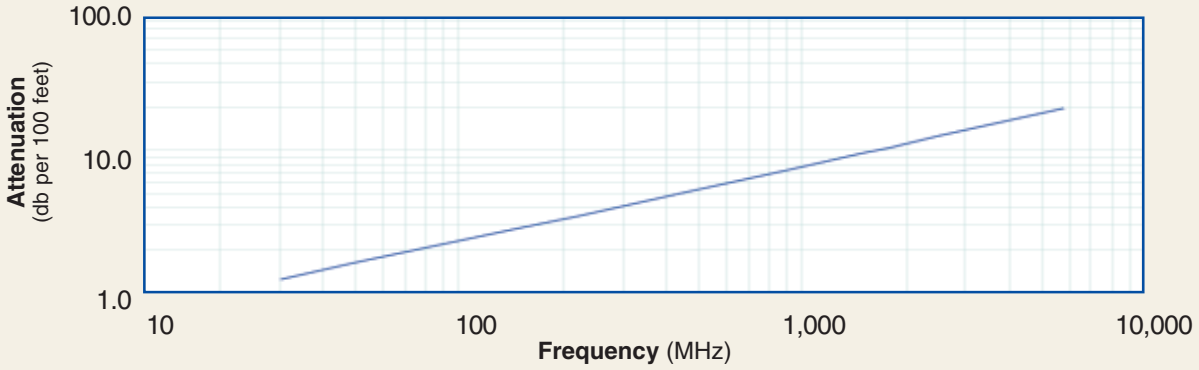
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	24.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.96	(9.7)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-300-UF	Indoor/Outdoor	TPE	Black	54088

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.3	1.6	2.9	3.5	5.1	7.3	9.5	10.5	11.1	12.5	19.8
Attenuation dB/100 m	4.2	5.4	9.4	11.5	16.6	23.8	31.2	34.4	36.4	41.0	65.0
Avg. Power kW	1.74	1.35	0.77	0.63	0.44	0.30	0.23	0.21	0.20	0.18	0.11

Calculate Attenuation = (0.230316) • $\sqrt{\text{FMHz}}$ + (0.000392) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-300-NM


TC-300-NM-RA


TC-300-SM


TC-300-SF-BH


TC-300-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	N/S	1.6 (41)	0.85 (21.6)	0.074(33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/S	1.5 (38)	0.85 (21.6)	0.101(45.8)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.35 (8.9)	0.018 (8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (28)	0.31 (7.9)	0.022(10.0)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7 (43)	0.59 (15.0)	0.050(22.7)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Ground Kit (each)


CT-300/400

Install Tools


CCT-01


GK-S300T

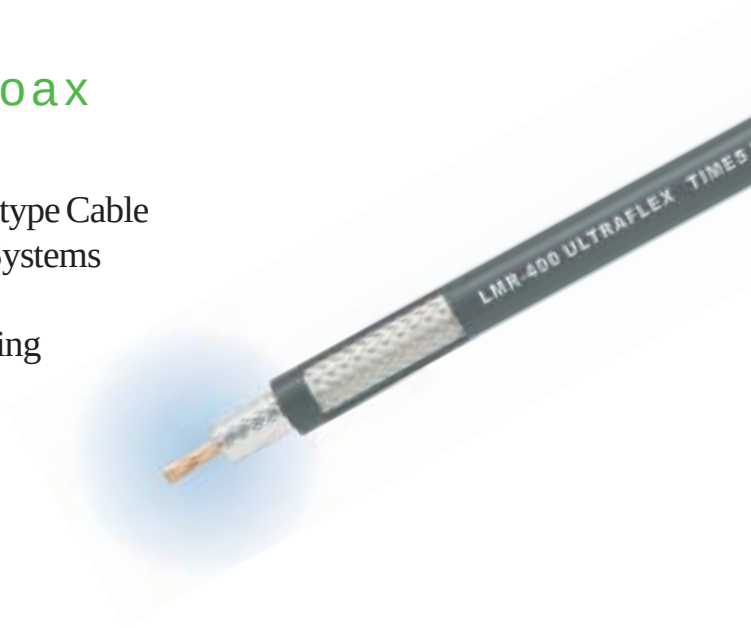
Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR-300 UF connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR-®400-UF
UltraFlex Communications Coax

Ideal for...

- Drop-in replacement for RG-8/9913 Air-Dielectric type Cable
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR®- UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-400-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-400-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR-400-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

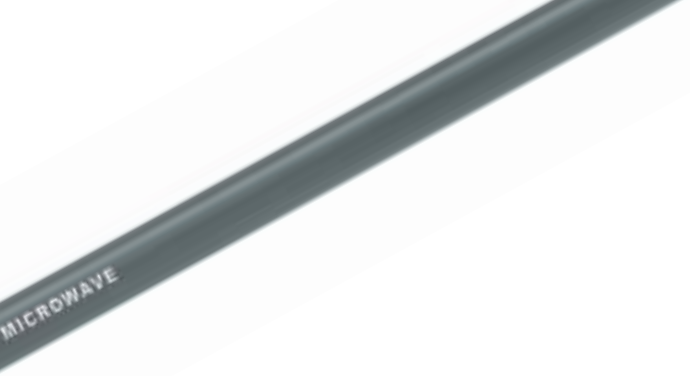
• **Cable Assemblies**: All LMR-400-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-400-UF	Indoor/Outdoor	TPE	Black	54040

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.108	(2.74)
Dielectric	Foam Polyethylene	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Black Thermoplastic Elastomer	0.405	(10.29)



Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.375	(0.51)
Weight	lb/ft (kg/m)	.088	(0.131)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

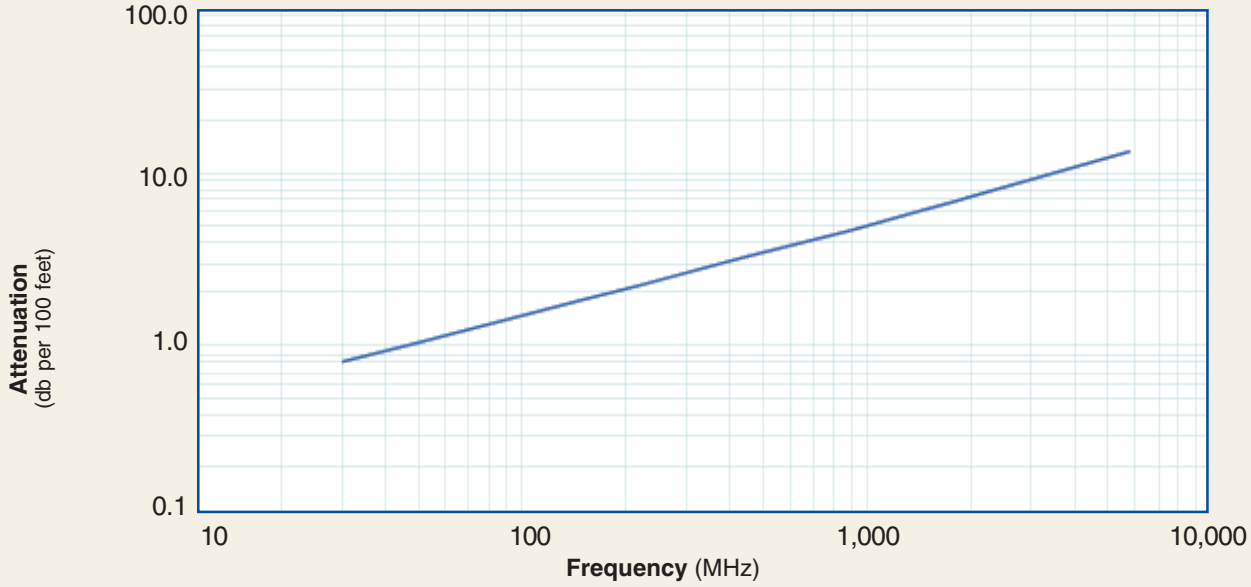
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	16.2	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.40)
Inductance	uH/ft (uH/m)	0.060	(0.21)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.07	(3.51)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.8	1.1	1.8	2.2	3.3	4.7	6.2	6.8	7.2	8.1	13.0
Attenuation dB/100 m	2.7	3.5	6.1	7.4	10.7	15.4	20.2	22.3	23.6	26.6	42.6
Avg. Power kW	2.77	2.14	1.22	1.00	0.69	0.48	0.36	0.33	0.31	0.28	0.17

Calculate Attenuation = (0.146748) • $\sqrt{\text{FMHz}}$ + (0.000312) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-400-UF
UltraFlex Communications Coax

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Female	Straight Jack	TC-400-716-FC	3190-376	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	1.6	(41)	1.13	(28.7)	0.281	(127.5)
7-16 DIN Male	Straight Plug	TC-400-716-MC	3190-279	<1.25:1 (2.5)	Hex	Solder	Clamp	S/S	1.4	(36)	1.40	(35.6)	0.268	(121.6)
BNC Male	Straight Plug	TC-400-BM	3190-318	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.56	(14.2)	0.063	(28.6)
Mini-UHF	Straight Plug	TC-400-MUHF	3190-520	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.50	(12.7)	0.020	(9.1)
N Female	Straight Jack	TC-400-NFC	3190-299	<1.25:1 (2.5)	NA	Solder	Clamp	N/S	1.6	(41)	0.75	(19.1)	0.119	(54.0)
N Male	Straight Plug	SC-400-NM	3190-1454	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
	Straight Plug	TC-400-NM	3190-188	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
	Straight Plug	TC-400-NMC	3190-277	<1.25:1 (2.5)	Knurl	Solder	Clamp	N/G	1.5	(38)	0.75	(19.1)	0.121	(54.9)
	Straight Plug	TC-400-NMH-D	3190-552	<1.25:1 (10)	Hex/Knurl	Solder	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.113	(51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8	(46)	1.25	(31.8)	0.130	(59.0)
SMA Male	Straight Plug	TC-400-SM	3190-439	<1.25:1 (8)	Hex	Solder	Crimp	N/G	1.2	(29)	0.50	(12.7)	0.032	(14.5)
TNC Male	Straight Plug	TC-400-TM	3190-260	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.074	(33.6)
	Right Angle	TC-400-TM-RA	3190-442	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.7	(43)	0.59	(15.0)	0.085	(38.6)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

GK-S400TT

HG-400T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400TT	GK-S400TT	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)

HX-4

Y1719

CT-400/300

CR-400

CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-500-UF UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing

• **LMR®- UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-500-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-500-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-500-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR-500-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-500-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.142	(3.61)
Dielectric	Foam Polyethylene	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	Black Thermoplastic Elastomer	0.500	(12.70)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.25	(1.69)
Weight	lb/ft (kg/m)	0.1	(0.15)
Tensile Strength	lb (kg)	260	(118.0)
Flat Plate Crush	lb/in. (kg/mm)	35	(0.63)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

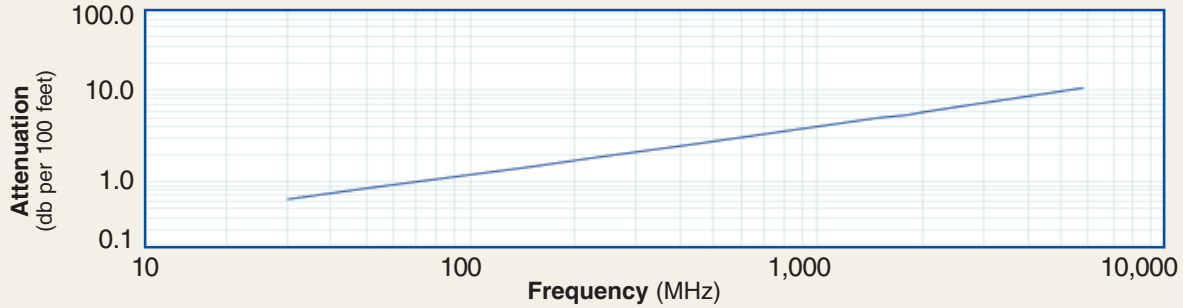
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	12	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.68	(2.21)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	22	

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-500-UF	Indoor/Outdoor	TPE	Black	54043

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.6	0.8	1.5	1.8	2.6	3.8	5.0	5.5	5.8	6.6	10.6
Attenuation dB/100 m	2.1	2.7	4.8	5.9	8.5	12.3	16.3	18.0	19.1	21.6	34.9
Avg. Power kW	3.68	2.84	1.61	1.32	0.91	0.63	0.48	0.43	0.41	0.36	0.22

Calculate Attenuation = (0.115908) • $\sqrt{\text{FMHz}}$ + (0.000312) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

Connectors

Interface	Description	Part Number	Stock Code	VSWR Freq. (GHz)		Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
N Male	Straight Plug	TC-500-NMC	3190-377	<1.25:1	(2.5)	Hex	Solder	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.228	(103.4)
	Right Angle	TC-500-NMC-RA	3190-227	<1.35:1	(2.5)	Hex	Solder	Clamp	S/G	2.4	(61)	1.5	(38.1)	0.275	(124.7)
N Female	Straight Jack	TC-500-NFC	3190-215	<1.25:1	(2.5)	NA	Solder	Clamp	S/G	2.2	(56)	0.94	(23.9)	0.215	(97.5)
	Bulkhead Kit	BHA-KIT	3190-223	<1.25:1	(2.5)	NA	NA	NA	NA	NA	NA	NA	NA	0.014	(6.4)
TNC Male	Straight Plug	TC-500-TM	3190-464	<1.25:1	(2.5)	Hex	Solder	Crimp	N/G	1.5	(38)	0.62	(15.7)	0.082	(28.1)
UHF Male	Straight Plug	TC-500-UMC	3190-354	<1.25:1	(2.5)	Knurl	Solder	Clamp	S/G	2.1	(53)	0.88	(22.4)	0.215	(97.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S500TT	GK-S500TT	Standard Ground Kit (each)

TIMES MICROWAVE SYSTEMS

LMR®-600-UF
UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing

• **LMR®- UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-600-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-600-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors**: A wide variety of connectors are available for LMR-600-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-600-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-600-UF	Indoor/Outdoor	TPE	Black	54044

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.176	(4.47)
Dielectric	Foam Polyethylene	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Black Thermoplastic Elastomer	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.165	(0.25)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

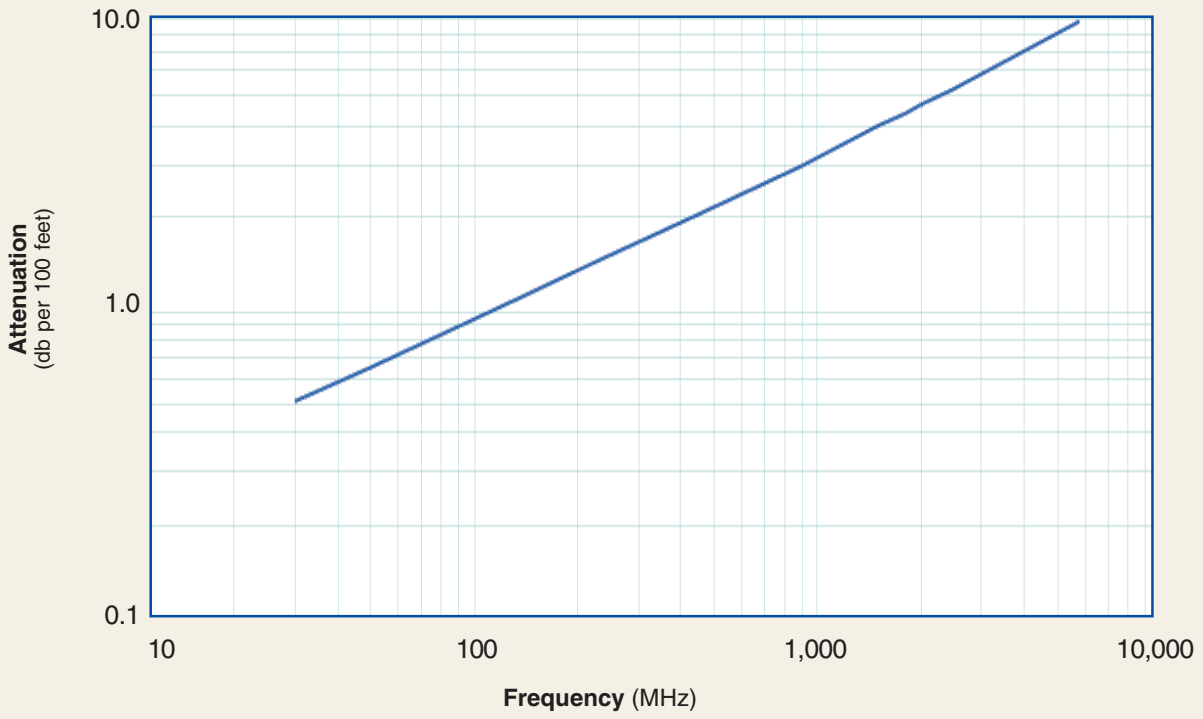
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	10	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.43	(1.42)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.5	0.7	1.2	1.4	2.1	3.0	4.0	4.4	4.7	5.3	8.7
Attenuation dB/100 m	1.7	2.2	3.8	4.6	6.8	9.8	13.1	14.5	15.3	17.4	28.6
Avg. Power kW	4.59	3.53	2.00	1.64	1.12	0.77	0.58	0.52	0.49	0.43	0.26

Calculate Attenuation =
$(0.090660) \bullet \sqrt{FMHz} + (0.000312) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-600-UF
UltraFlex Communications Coax

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Female	Straight Jack	TC-600-716-FC	3190-375	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	1.1	(28)	1.00	(25.4)	0.249	(112.9)
7-16 DIN Male	Straight Plug	TC-600-716-MC	3190-502	<1.25:1 (2.5)	Hex	Solder	Clamp	S/S	2.0	(51)	1.30	(33.0)	0.347	(157.4)
	Right Angle	TC-600-716M-RA	3190-395	<1.35:1 (2.5)	Hex	Solder	Crimp	S/S	1.4	(36)	1.40	(35.6)	0.354	(160.8)
7/8 EIA	Flange	TC-600-78EIA	3190-321	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	2.3	(58)	2.60	(66.0)	0.873	(396.0)
N Male	Straight Plug	TC-600-NMH-D	3190-208	<1.25:1 (2.5)	Hex/Knurl	Solder	Crimp	S/G	2.1	(53)	0.92	(23.4)	0.166	(75.3)
	Straight Plug	TC-600-NMC	3190-357	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.208	(93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.280	(117.9)
N Female	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1 (2.5)	NA	Solder	Crimp	S/G	2.4	(61)	0.88	(22.4)	0.195	(88.5)
	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2	(56)	0.94	(23.9)	0.214	(97.1)
UHF Male	Straight Plug	TC-600-UMC	3190-213	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43)	0.88	(22.4)	0.198	(89.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


Y1720


HX-4

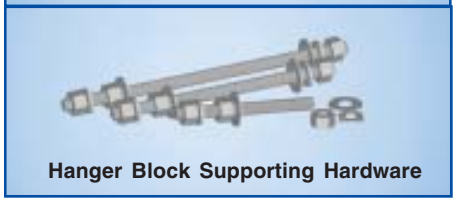

CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


GK-S600TT


CS-A600T,
CS-60120T, CS-60170T


Hanger Block Supporting Hardware


SC-600T


Standard Entry Panels


HG-600T


CB-600T

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Standard Entry Port Cushion	SC-600T	SC-600T	Three Cables (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		

TIMES MICROWAVE SYSTEMS

LMR®-195-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-195-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-195-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-195-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: A variety of connectors are available for LMR-195-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-195-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Low density PTFE	0.113	(2.87)
Outer Conductor	Aluminum Tape	0.119	(3.02)
Overall Braid	Tinned Copper	0.142	(3.61)
Jacket	Orange FRPVC	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2.0	(50.8)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.021	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

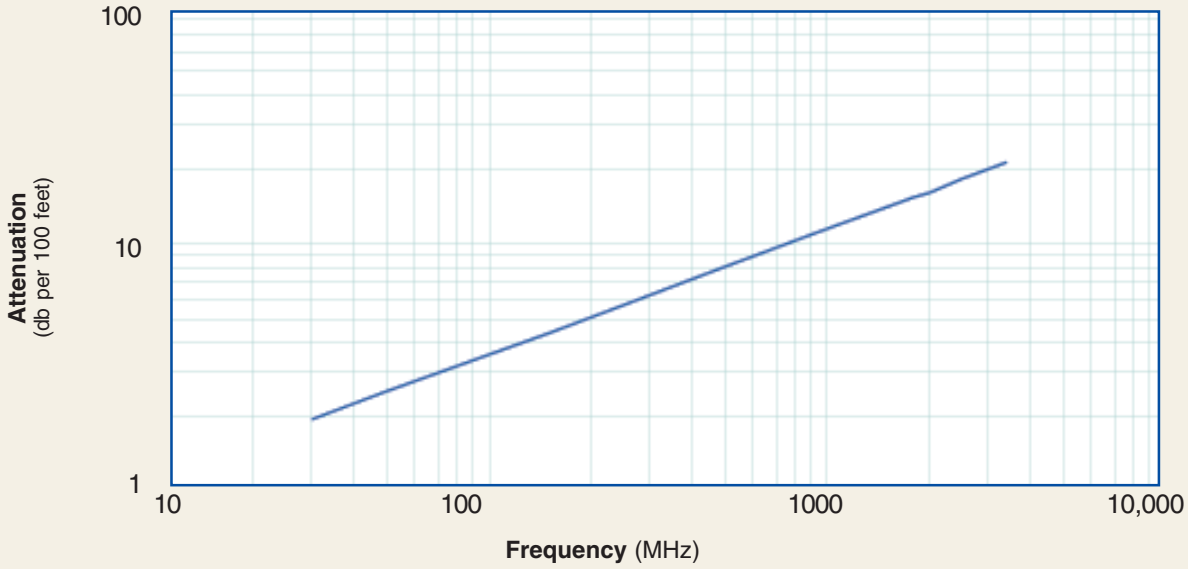
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.6	(24.9)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-195-LLPL	Indoor Plenum 'CMP'	FRPVC	Orange	54211

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	2.0	2.5	4.4	5.3	7.8	10.9	14.1	15.4	16.3	18.3	21.4	28.2
Attenuation dB/100 m	6.4	8.3	14.4	17.5	25.1	35.6	46.2	50.7	53.5	60.0	70.2	92.5
Avg. Power kW	0.70	0.54	0.31	0.26	0.18	0.12	0.10	0.09	0.08	0.07	0.06	0.05

Calculate Attenuation =
$(0.356297) \bullet \sqrt{FMHz} + (0.000183) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-195-NM


TC-195-SM


TC-195-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Install Tools


CT-240/200/195/100


CCT-01

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-200-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-200-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-200-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: A variety of connectors are available for LMR-200-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-200-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-200-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54058

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid Bare Copper	0.040	(1.02)
Dielectric	Low density PTFE	0.118	(3.00)
Outer Conductor	Aluminum Tape	0.123	(3.12)
Overall Braid	Tinned Copper	0.146	(3.71)
Jacket	Orange FRPVC	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2.0	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.032	(0.05)
Tensile Strength	lb (kg)	30	(13.6)
Flat Plate Crush	lb/in. (kg/mm)	65	(1.16)

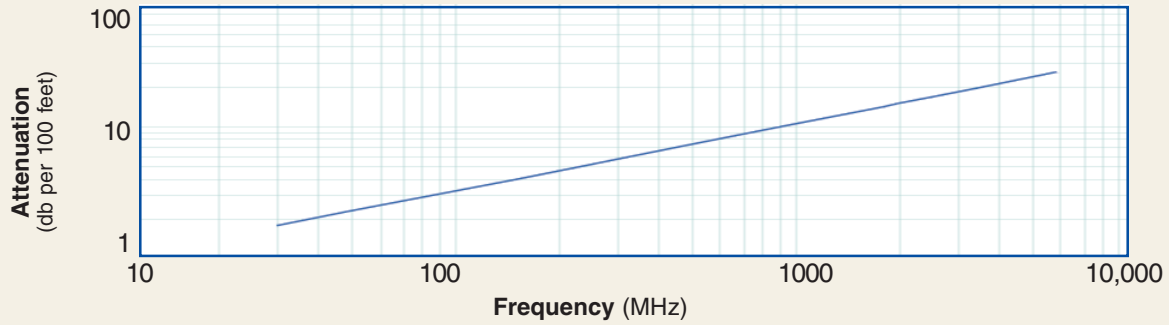
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	6.5	(21.3)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.8	2.3	4.1	4.9	7.1	10.0	13.0	14.3	15.1	16.0	19.8	26.1
Attenuation dB/100 m	5.9	7.7	13.3	16.1	23.2	32.9	42.7	48.9	49.5	55.5	65.0	85.7
Avg. Power kW	0.77	0.59	0.34	0.28	0.19	0.14	0.11	0.10	0.09	0.08	0.07	0.05

Calculate Attenuation = (0.329080) • $\sqrt{\text{FMHz}}$ + (0.00018) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
VSWR = 1.0, Ambient = +40C; Jacket = +75C (167F); Sea Level; dry air; atmospheric pressure; no solar loading

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
BNC Male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7	(43.2)	0.56	(14.2)	0.045	(20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1	(27.9)	0.45	(11.4)	0.015	(6.8)
N Male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5	(38.1)	0.75	(19.1)	0.073	(33.1)
	Reverse Polarity	TC-200-NM-RP	3190-959	<1:25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38.0)	0.75	(19.1)	0.073	(33.1)
TNC Male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43.2)	0.59	(15.0)	0.045	(20.4)
TNC Female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.3	(33.0)	0.57	(14.5)	0.033	(15.0)
SMA-Male	Straight plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.015	(6.8)
SMA-Rev.Polarity	Straight Plug	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.015	(6.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200TT	GK-S200TT	Standard Ground Kit (each)

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-240-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-240-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-240-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: A variety of connectors are available for LMR-240-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-240-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-240-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54059

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid Bare Copper	0.051	(1.30)
Dielectric	Low density PTFE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	Orange FRPVC	0.240	(6.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.047	(0.07)
Tensile Strength	lb (kg)	60	(27.22)
Flat Plate Crush	lb/in. (kg/mm)	85	(1.52)

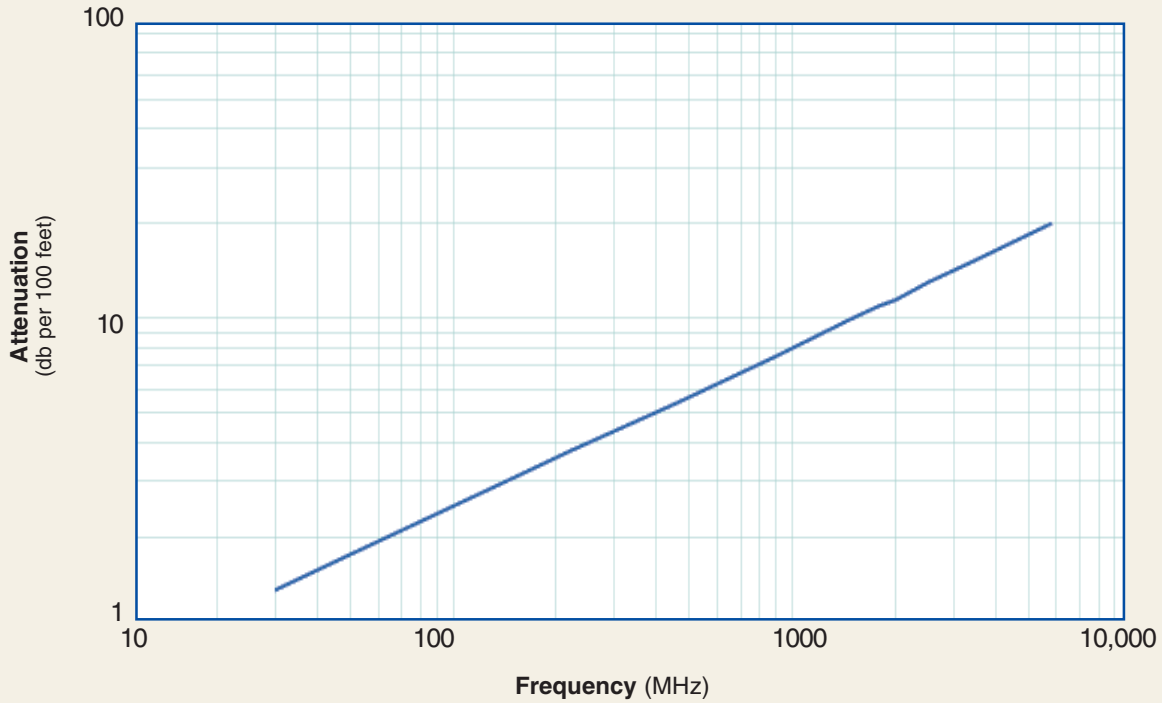
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	28	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	4.0	(13.1)
Outer Conductor	ohms/1000ft (/km)	3.9	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.4	1.8	3.1	3.7	5.4	7.6	9,9	10.9	11.5	12.9	15.1	20.0
Attenuation dB/100 m	4.5	5,8	10.1	12.2	17.6	25.0	32.5	35.7	37.7	42.3	49.6	65.6
Avg. Power kW	1.18	0.91	0.52	0.43	0.30	0.21	0.16	0.15	0.14	0.12	0.10	0.08

Calculate Attenuation =
$(0.248520) \bullet \sqrt{FMHz} + (0.000183) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-240-LLPL
Flexible Low Loss Plenum Coax

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.56 (14.2)	0.040 (18.1)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1 (28)	0.45 (11.4)	0.014 (6.4))
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25 (2.5)	NA	Solder	Crimp	A/G	1.7 (44)	0.88 (22.2)	0.115 (52.2)
N Male	Straight Plug	TC-240-NM	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	N/S	1.5 (38)	0.75 (19.1)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5 (38)	0.75 (19.1)	0.082 (37.2)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (29)	0.31 (7.9)	0.019 (8.6)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8 (20)	0.65 (16.5)	0.019 (8.6)
SMA Male	Rev. Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7 (43)	0.59 (15.0)	0.043 (19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.3 (33)	0.57 (14.5)	0.055 (24.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

GK-S240TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240TT	GK-S240TT	Standard Ground Kit (each)

CT-240/200/195/100

CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-300-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-300-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-300-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: A variety of connectors are available for LMR-300-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-300-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-300-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54175

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid Bare Copper	0.063	(1.60)
Dielectric	Low density PTFE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Orange FRPVC	0.300	(7.62)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.875	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

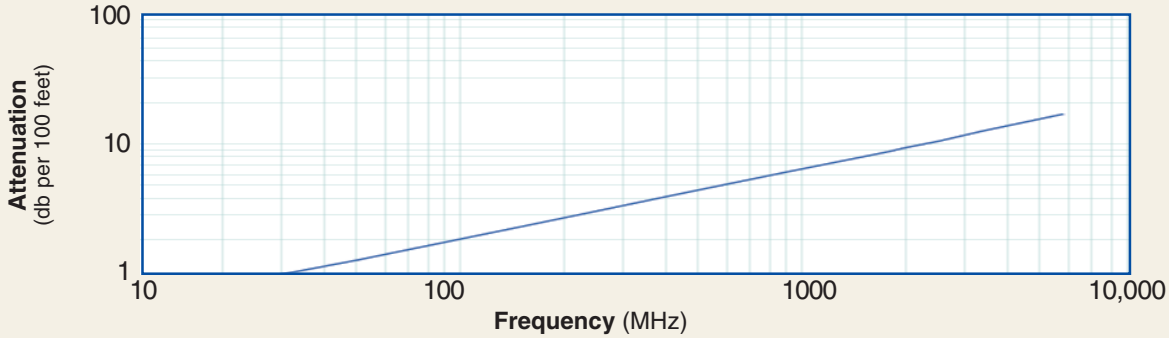
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	23	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.61	(8.6)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.1	1.4	2.5	3.0	4.3	6.2	8.1	8.9	9.4	10.5	12.3	16.4
Attenuation dB/100 m	3.6	4.7	8.2	9.9	14.3	20.3	26.4	29.1	30.7	34.5	40.5	53.7
Avg. Power kW	1.72	1.33	0.77	0.63	0.44	0.31	0.24	0.21	0.20	0.18	0.15	0.11

Calculate Attenuation = (0.200950) • $\sqrt{\text{FMHz}}$ + (0.000183) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F);
Sea Level; dry air; atmospheric pressure; no solar loading


TC-300-NM


TC-300-NM-RA


TC-300-TM


TC-300-SM


TC-300-SF-BH

Connectors

Interface	Description	Part Number	Stock Code	VSWR Freq.	(GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1	(6)	Knurl	Solder	Crimp	N/S	1.6	(41)	0.85	(21.6)	0.074	(33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1	(2.5)	Knurl	Solder	Crimp	N/S	1.5	(38)	0.85	(21.6)	0.101	(45.8)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1	(2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.35	(8.9)	0.018	(8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1	(2.5)	NA	Solder	Crimp	SS/G	1.1	(28)	0.31	(7.9)	0.022	(10.0)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1	(2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.050	(22.7)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300TT	GK-S300TT	Standard Ground Kit (each)


GK-S300TT


CT-400/300


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 300 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

LMR®-400-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-400-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-400-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: A variety of connectors are available for LMR-400-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-400-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-400-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54070

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.095	(2.41)
Dielectric	Low density PTFE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Orange FRPVC	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.114	(0.17)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	185	(3.31)

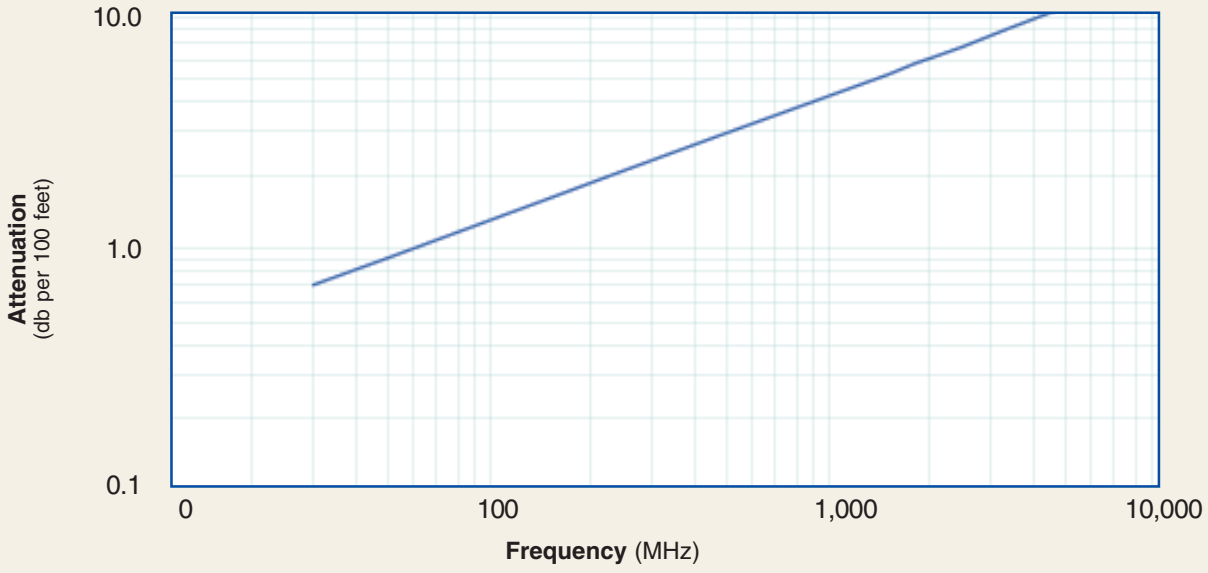
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	15	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.8	(5.9)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.7	0.9	1.6	1.9	2.8	4.0	5.2	5.7	6.1	6.8	8.0	10.7
Attenuation dB/100 m	2.3	3.0	5.3	6.4	9.2	13.2	17.1	18.9	19.9	22.4	26.4	35.1
Avg. Power kW	3.33	2.57	1.48	1.22	0.84	0.59	0.45	0.41	0.39	0.34	0.29	0.22

Calculate Attenuation =
$(0.129140) \bullet \sqrt{FMHz} + (0.000150) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-400-LLPL
Flexible Low Loss Plenum Coax


TC-400-NF-PL


EZ-400-NMH-PL-D


TC-400-NMH-PL


TC-400-NMH-RA

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Female	Straight Jack	TC-400-NF-PL	3190-964	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.8 (45)	0.66 (16.8)	0.105 (47.6)
N Male	Straight Plug	EZ-400-NMH-PL-D	3190-602	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMH-PL	3190-759	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130 (59.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S400TT


HG-400T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400TT	GK-S400TT	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)

HX-4

Y1719

CT-400/300


ST-400C, ST-400EZ


DBT-01


CCT-01


TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	For Clamp Connectors
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

LMR®-500-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-500-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-500-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-500-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: A variety of connectors are available for LMR-500-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies**: All LMR-500-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-500-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54060

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.123	(3.12)
Dielectric	Low density PTFE	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	Orange FRPVC	0.500	(12.70)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.194	(0.29)
Tensile Strength	lb (kg)	195	(88.5)
Flat Plate Crush	lb/in. (kg/mm)	200	(3.57)

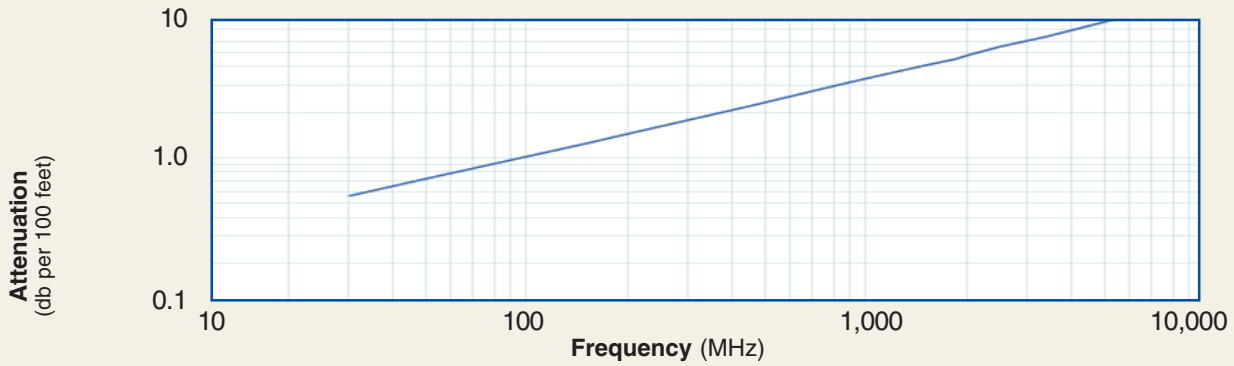
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	11.6	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.09	(3.6)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	11.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.6	0.7	1.3	1.5	2.2	3.1	4.1	4.5	4.8	5.4	6.4	8.5
Attenuaiton dB/100 m	1.8	2.4	4.1	5.0	7.2	10.3	13.5	14.8	15.7	17.7	20.9	27.9
Avg. Power kW	4.99	3.86	2.21	1.82	1.26	0.88	0.67	0.61	0.58	0.51	0.43	0.32

Calculate Attenuation = (0.100260) • $\sqrt{\text{FMHz}}$ + (0.000150) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F);
Sea Level; dry air; atmospheric pressure; no solar loading


TC-500-NMC-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-500-NMC-PL	3190-900	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


HX-4


Y151


ST-500C


DBT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CCT-01

TIMES MICROWAVE SYSTEMS

LMR®-600-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

- **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.
- **Flexibility** and bendability are hallmarks of the LMR-600-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
- **Low Loss** is another hallmark feature of LMR-600-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
- **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
- **Weatherability**: LMR-600-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.
- **Connectors**: A variety of connectors are available for LMR-600-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.
- **Cable Assemblies**: All LMR-600-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-600-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54061

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.150	(3.81)
Dielectric	Low density PTFE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Orange FRPVC	0.590	(14.99)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

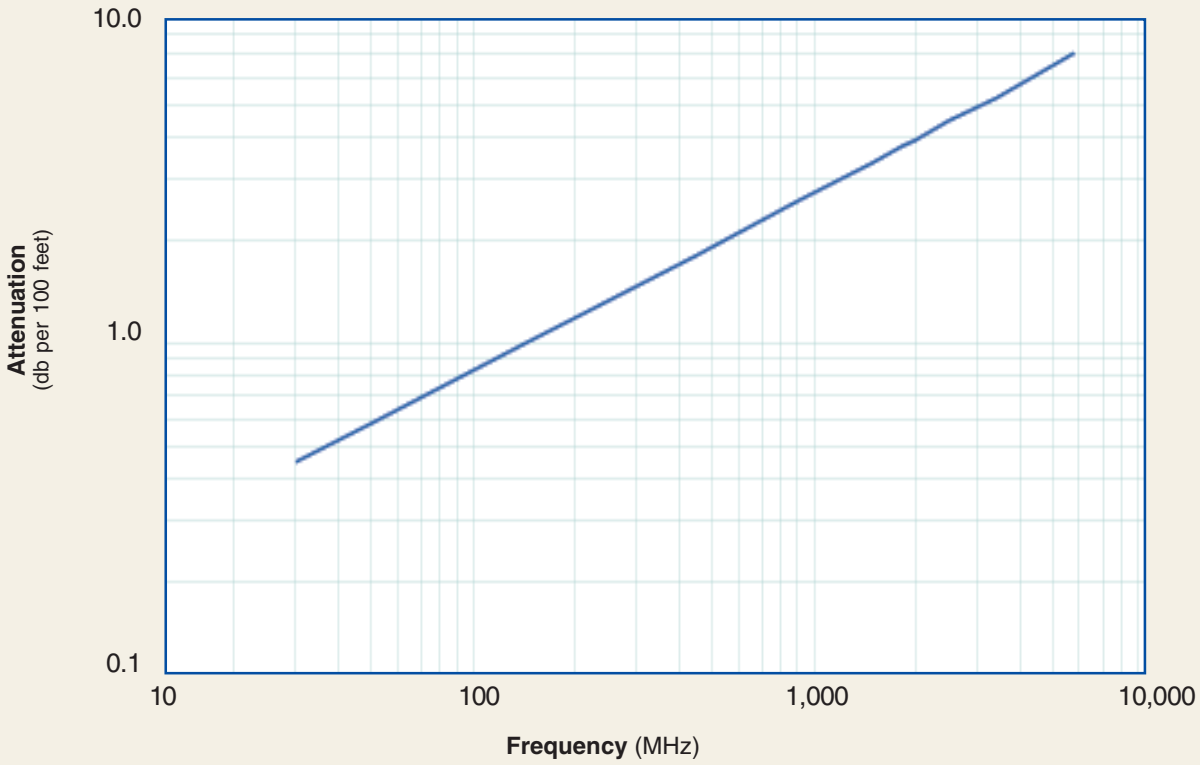
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	9.4	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.73	(2.40)
Outer Conductor	ohms/1000ft (/km)	1.20	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38.1)
Bend Radius: repeated	in (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.24	(0.36)
Tensile Strength	lb (kg)	265	(120.3)
Flat Plate Crush	lb/in. (kg/mm)	210	(3.75)

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.5	0.6	1.0	1.2	1.8	2.6	3.4	3.7	3.9	4.4	5.3	7.1
Attenuation dB/100 m	1.5	1.9	3.3	4.1	5.9	8.5	11.1	12.2	12.9	14.5	17.2	23.2
Avg. Power kW	6.97	5.39	3.08	2.53	1.75	1.22	0.93	0.84	0.79	0.70	0.59	0.44

Calculate Attenuation =
$(0.081390) \bullet \sqrt{FMHz} + (0.000150) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-600-LLPL
Flexible Low Loss Plenum Coax


TC-600-LCM-PL


EZ-600-NMH-PL-D


TC-600-NMH-PL


TC-600-NMC-RA


TC-600-NMH-RA

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
LC Male	Straight plug	TC-600-LCM-PL	3190-1221	<1.25:1 (1)	Hex	Solder	Clamp	N/S	3.1 (78.7)	1.62 (41.1)	1.20 (544)
N Male	Straight Plug	EZ-600-NMH-PL-D	3190-603	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166(75.3)
	Straight Plug	TC-600-NMH-PL	3190-760	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.208(93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.280(17.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.185(83.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S600TT


HG-600T


CS-A600T, CS-60120T, CS-60170T


CB-600T


Hanger Block Hardware

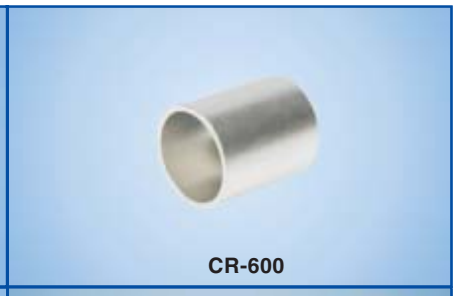

SH-U600T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)

HX-4

Y1720



CR-600

ST-600C

ST-600EZ

DBT-01

TK-600EZ

GST-600A

CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	ST-600C	3190-230	For Clamp Style Connectors
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

LMR®-900-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-900-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-900-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-900-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: Type-N and 7-16 male and female connectors are available for LMR-900-LLPL cable. Other interface types can be provided by using a short jumper cable assembly.

• **Cable Assemblies**: All LMR-900-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-900-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54062

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.227	(5.77)
Dielectric	Low density PTFE	0.680	(17.27)
Outer Conductor	Aluminum Tape	0.686	(17.42)
Overall Braid	Tinned Copper	0.732	(18.59)
Jacket	Orange FRPVC	0.870	(22.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	4.5	(114.3)
Bend Radius: repeated	in. (mm)	9.0	(228.6)
Bending Moment	ft-lbs (N-m)	9.0	(12.20)
Weight	lbs/ft (kg/m)	0.62	(0.92)
Tensile Strength	lbs (kg)	660	(299.6)
Flat Plate Crush	lbs/in. (kg/mm)	300	(5.36)

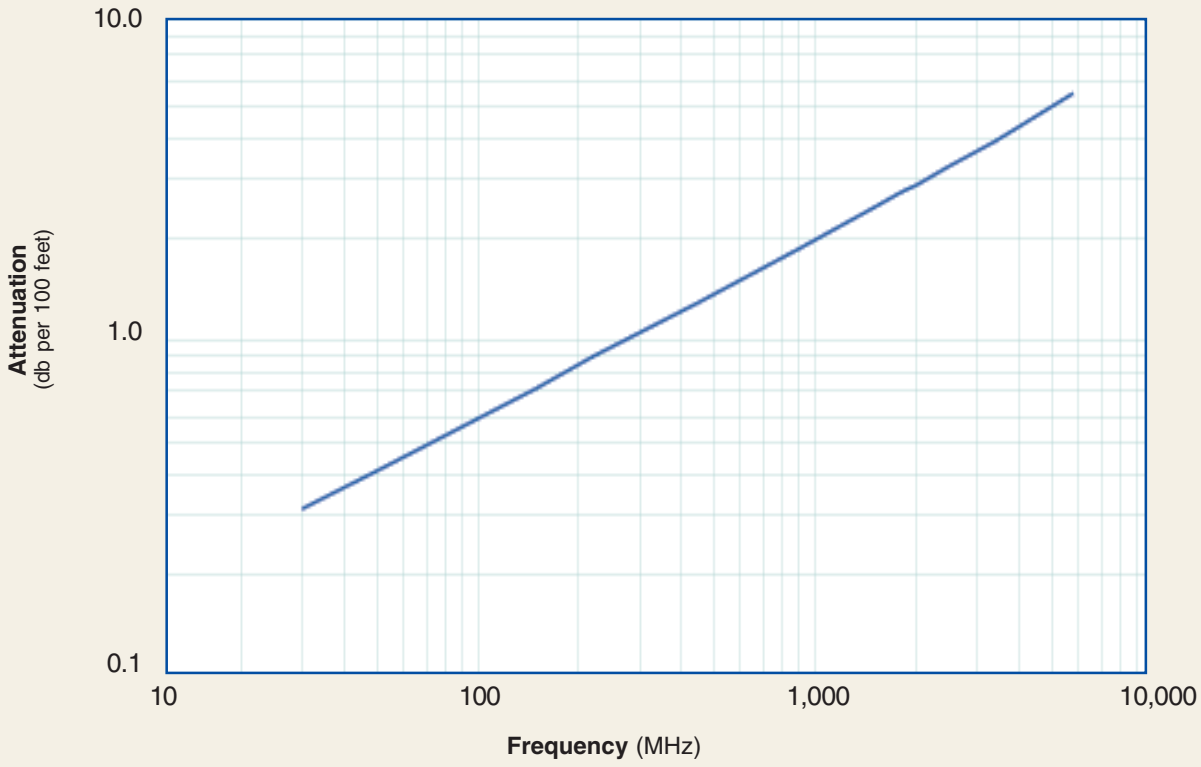
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	6.3	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.63	(2.07)
Outer Conductor	ohms/1000ft (/km)	0.55	(1.8)
Voltage Withstand	Volts DC	5000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	82	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.3	0.4	0.7	0.9	1.3	1.9	2.5	2.8	2.9	3.3	4.0	5.4
Attenuation dB/100 m	1.0	1.4	2.4	2.9	4.3	6.2	8.2	9.0	9.6	10.9	13.0	17.8
Avg. Power kW	13.21	19.18	5.77	4.74	3.25	2.24	1.69	1.52	1.44	1.26	1.06	0.77

Calculate Attenuation =
$(0.057220) \bullet \sqrt{FMHz} + (0.000183) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Jacket = +75°C (167°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-900-LLPL
Flexible Low Loss Plenum Coax


EZ-900-716FC-PL-2


EZ-900-716MC-PL-2


EZ-900-NFC-PL-2


EZ-900-NMC-PL-2

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq.	(GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
716 Female	Straight Jack	EZ-900-716-FC-PL-2	3190-1550	<1.25:1	(2.5)	NA	Press Fit	Clamp	S/S	2.0	(51)	1.38	(35.1)	0.379	(171.9)
716 Male	Straight Plug	EZ-900-716-MC-PL-2	3190-1549	<1.25:1	(2.5)	Hex	Press Fit	Clamp	S/S	2.0	(51)	1.44	(36.6)	0.485	(220.0)
N Female	Straight Jack	EZ-900-NFC-PL-2	3190-1586	<1.25:1	(2.5)	NA	Press Fit	Clamp	S/G	2.0	(51)	1.38	(35.1)	0.443	(200.9)
N Male	Straight Plug	EZ-900-NMC-PL-2	3190-1585	<1.25:1	(2.5)	Hex	Press Fit	Clamp	S/S	2.0	(51)	1.38	(35.1)	0.463	(210.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


ST-900/1200C


ST900C


GST-900A


WR-900


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-900C	3190-1310	For LMR 900 Clamp Style Connectors
Midspan Strip Tool	GST-900A	3190-435	For Ground Strap Attachment
Wrenches	WR-900	3190-510	1-1/4" Box Wrench (2 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S900TT	GK-S900TT	Standard Grounding Kit (each)
Hoisting Grip	HG-900T	HG-900T	Split/Laced Type (each)
Cold Shrink	CS-A900T	CS-A900T	Cable to Antenna Junction (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-90170T	CS-90170T	LMR-900 to -1700 Junction (each)
Port Cushion	SC-900T	SC-900T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-900T	CB-900T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware and Adapters Available
Snap-in Hangers	SH-U900T	SH-U900T	Snap-in Hanger (Kit of 10)

TIMES MICROWAVE SYSTEMS

LMR®-1200-LLPL
Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®- LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-1200-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-1200-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-1200-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors**: Type-N male and female connectors are available for LMR-1200-LLPL cable. Other interface types can be provided by using a short jumper cable assembly.

• **Cable Assemblies**: All LMR-1200-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-1200-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54063

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.310	(7.87)
Dielectric	Low density PTFE	0.920	(23.37)
Outer Conductor	Aluminum Tape	0.926	(23.52)
Overall Braid	Tinned Copper	0.937	(23.80)
Jacket	Orange FRPVC	1.200	(30.48)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	6.0	(152.4)
Bend Radius: repeated	in.s (mm)	12.0	(304.8)
Bending Moment	ft-lbs (N-m)	15.0	(20.34)
Weight	lbs/ft (kg/m)	0.7	(1.04)
Tensile Strength	lbs (kg)	975	(442.7)
Flat Plate Crush	lbs/in. (kg/mm)	375	(6.70)

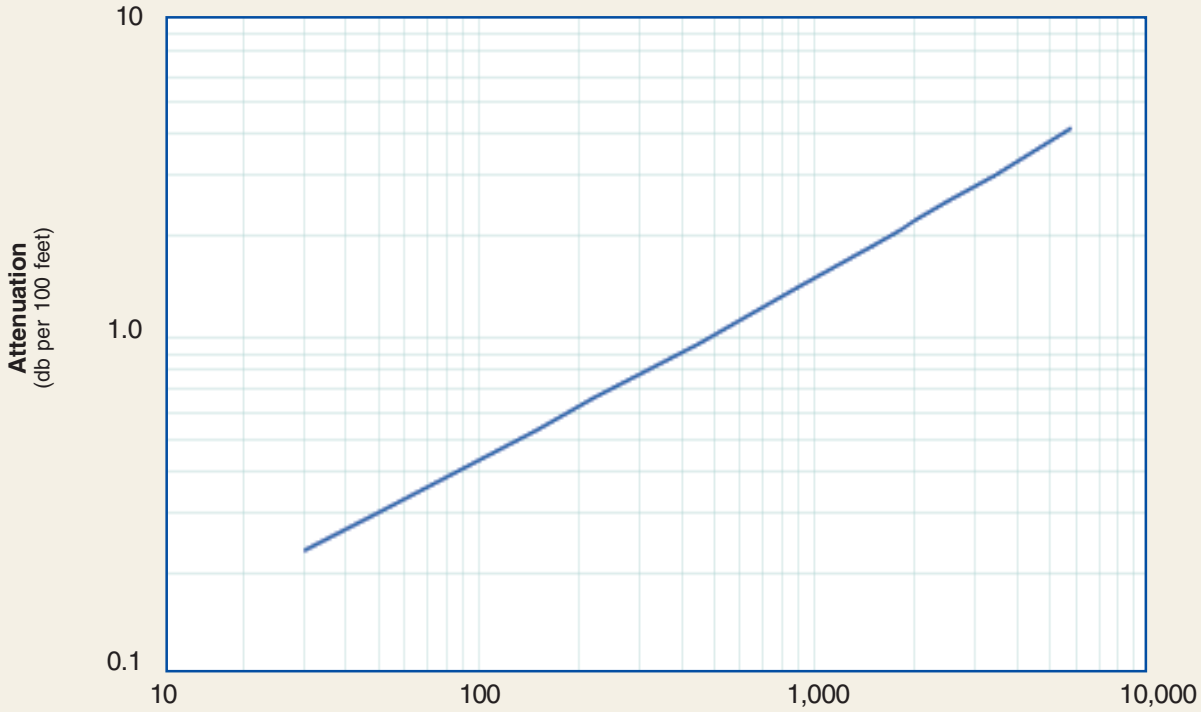
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	+23/+167	-5/+75
Storage Temperature Range	+23/+167	-5/+75
Operating Temperature Range	+23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	4.6	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.37	(1.21)
Outer Conductor	ohms/1000ft (/km)	0.37	(1.2)
Voltage Withstand	Volts DC	6000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	90	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400
Attenuation dB/100 ft	0.2	0.3	0.5	0.7	1.0	1.4	1.9	2.1	2.2	2.5	3.1
Attenuation dB/100 m	0.8	1.0	1.8	2.2	3.2	4.6	6.2	6.9	7.3	8.3	10.0
Avg. Power kW	23.42	18.01	10.17	8.31	5.66	3.86	2.90	2.60	2.45	2.15	1.79

Calculate Attenuation =
$(0.041720) \bullet \sqrt{FMHz} + (0.000183) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Jacketr = +75°C (167°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-1200-LLPL
Flexible Low Loss Plenum Coax


EZ-1200-NMC-PL


EZ-1200-NFC-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Female	Straight Jack	EZ-1200-NFC PL	3190-912	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.650(294.8)
N Male	Straight Plug	EZ-1200-NMC PL	3190-911	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.659(298.9)

* Finishes: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


ST-900/1200C


ST-1200C


GST-1200A


WR-1200A, WR1200B


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-1200C	3190-1311	For LMR 1200 Clamp Style Connectors
Midspan Strip Tool	GST-1200A	3190-436	For Ground Strap Attachment
Wrench	WR-1200A	3190-512	1-9/16" Box Wrench (1 required)
Wrench	WR-1200B	3190-511	1-7/16" Box Wrench Pair (1 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S1200TT	GK-S1200TT	Standard Grounding Kit (each)
Hoisting Grip	HG-1200T	HG-1200T	Split/Laced Type (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Standard Entry Port Cushion	SC-1200T	SC-1200T	Three Cables (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-1200T	CB-1200T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		
Snap-In Hangers	SH-U1200T	SH-U1200T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

LMR®-200-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable

• **LMR®-75** standard 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.

• **Flexibility** and bendability are hallmarks of the LMR-200-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-200-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies**: All LMR-200-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-200-75	Indoor/Outdoor	PE	Black	54213
LMR-200-75-DB	Outdoor	PE	Black	54242

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.025	(0.64)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Tinned Copper	0.144	(3.66)
Jacket	Black PE	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.022	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

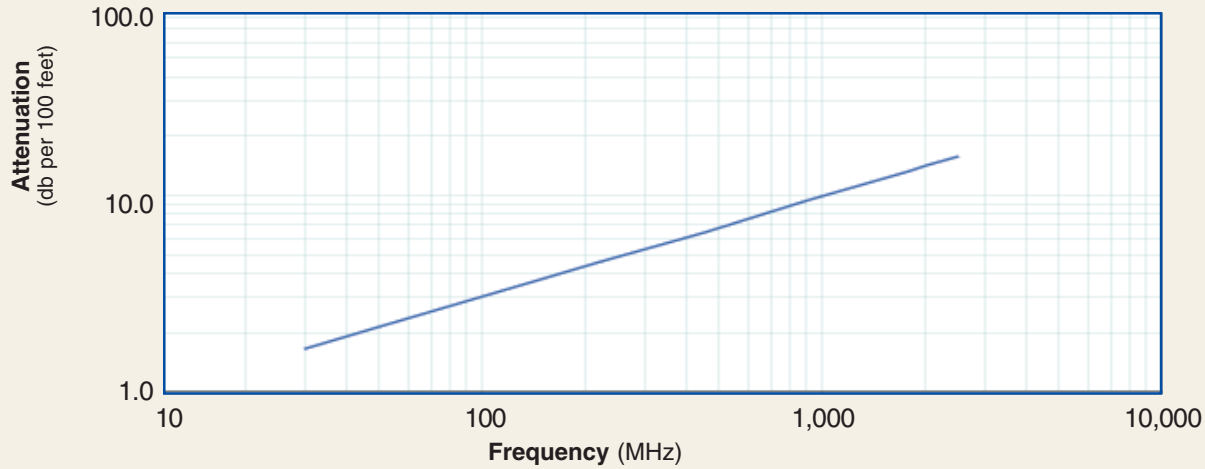
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	16.3	(53.6)
Inductance	uH/ft (uH/m)	0.092	(0.30)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	16.8	(55.1)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	1.7	2.1	3.7	4.5	6.5	9.3	12.1	13.4	14.1	15.9
Attenuation dB/100 m	5.4	7.0	12.2	14.9	21.4	30.6	39.8	43.8	46.3	52.0
Avg. Power kW	0.98	0.76	0.43	0.36	0.25	0.17	0.13	0.12	0.11	0.10

Calculate Attenuation = (0.300717) • $\sqrt{\text{FMHz}}$ + (0.000335) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F)
Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


EZ-200-FMH-75


EZ-200-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)		Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
F male	Straight Plug	EZ-200-FMH-75	3190-1611	<1.35:1	(2.5)	Hex	Spring Finger	Crimp	N/G	1.1	(27.0)	0.50	(12.7)	0.015	(6.8)
N male	Straight Plug	EZ-200-NM-75	3190-1612	<1.35:1	(2.5)	Knurl	Spring Finger	Crimp	N/G	1.5	(38.1)	0.83	(21.1)	0.073	(33.1)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S200TT

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200TT	GK-S200TT	Standard Grounding Kit

TIMES MICROWAVE SYSTEMS

LMR®-240-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable

• **LMR®-75** standard 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.

• **Flexibility** and bendability are hallmarks of the LMR-240-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-240-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies**: All LMR-240-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-240-75	Indoor/Outdoor	PE	Black	54150
LMR-240-75-DB	Outdoor	PE	Black	54226

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.032	(0.82)
Dielectric	Foam PE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	Black PE	0.240	(6.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.8	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile Strength	lb (kg)	80	(38.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

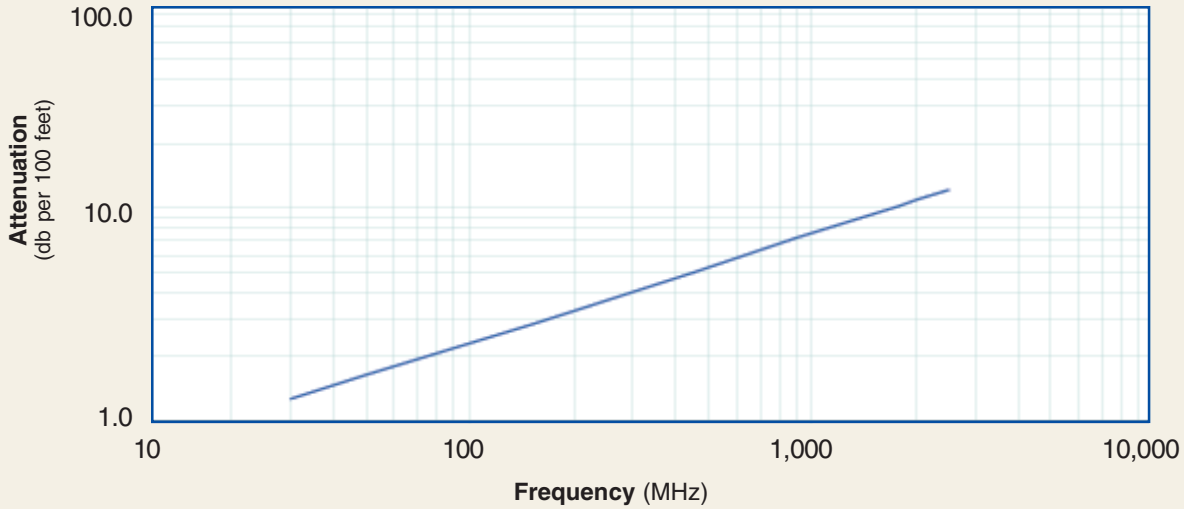
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	16.1	(52.9)
Inductance	uH/ft (uH/m)	0.091	(0.30)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	10.1	(33.1)
Outer Conductor	ohms/1000ft (/km)	3.89	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	1.3	1.6	2.9	3.5	5.0	7.2	9.4	10.3	10.9	12.3
Attenuation dB/100 m	4.1	5.4	9.4	11.4	16.4	23.5	30.7	33.8	35.8	40.3
Avg. Power kW	1.41	1.09	0.62	0.51	0.35	0.25	0.19	10.17	0.16	0.14

Calculate Attenuation =
$(0.229100) \bullet \sqrt{FMHz} + (0.000330) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


EZ-240-FMH-75


TC-240-FMH-75


EZ-240-NM-75


TC-240-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F Male	Straight Plug	EZ-240-FMH-75	3190-1613	<1.25:1 (2.0)	Hex	Spring Finger	Crimp	N/G	1.7 (43.4)	0.56 (14.2)	0.016 (7.3)
	Straight Plug	TC-240-FMH-75	3190-1483	<1.25:1 (2.5)	Hex	Solder-on	Crimp	N/G	1.7 (43.2)	0.56 (14.2)	0.016 (7.3)
N Male	Straight Plug	EZ-240-NM-75	3190-1614	<1.25:1 (2.0)	Knurl	Spring Finger	Crimp	N/G	1.5 (38.1)	0.83 (21.1)	0.086 (39.0)
	Straight Plug	TC-240-NM-75	3190-477	<1.25:1 (2.5)	Knurl	Solder-on	Crimp	N/G	1.5 (38.1)	0.83 (21.1)	0.086 (39.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240TT	GK-S240TT	Standard Grounding Kit


GK-S240TT

TIMES MICROWAVE SYSTEMS

LMR®-300-75 Ohm
Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable

• **LMR®-75** standard 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.

• **Flexibility** and bendability are hallmarks of the LMR-300-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-300-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies**: All LMR-300-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-300-75	Indoor/Outdoor	PE	Black	54146
LMR-300-75-DB	Outdoor	PE	Black	54241

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Black PE	0.300	(7.62)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.875	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

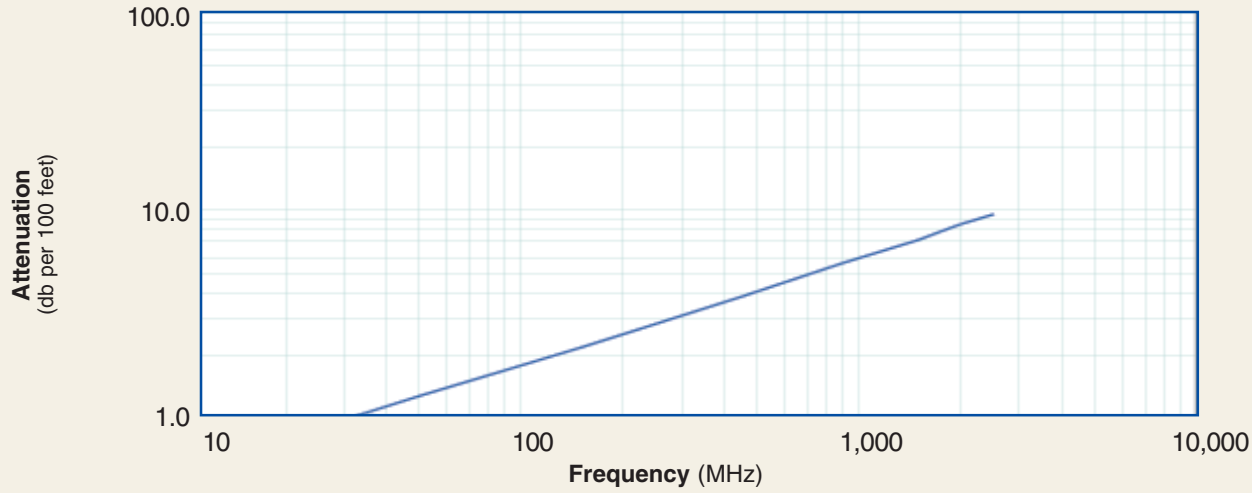
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	15.9	(52.3)
Inductance	uH/ft (uH/m)	0.090	(0.29)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	1.0	1.3	2.2	2.7	3.9	5.6	7.3	8.0	8.5	9.6
Attenuation dB/100 m	3.2	4.1	7.2	8.8	12.7	18.2	23.9	26.4	27.9	31.5
Avg. Power kW	2.06	1.59	0.91	0.74	0.51	0.36	0.27	0.25	0.23	0.21

Calculate Attenuation = (0.175490) • $\sqrt{\text{FMHz}}$ + (0.000330) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading


EZ-300-FMH-75


EZ-300-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F male	Straight Plug	EZ-300-FMH-75	3190-1615	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	N/G	1.7 (43.2)	0.56 (14.2)	0.018 (8.2)
N male	Straight Plug	EZ-300-NM-75	3190-1616	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/G	1.5 (38.1)	0.83 (21.1)	0.074(33.6)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR specbased on 3 foot cable with a connector pair


GK-S200TT

Accessories

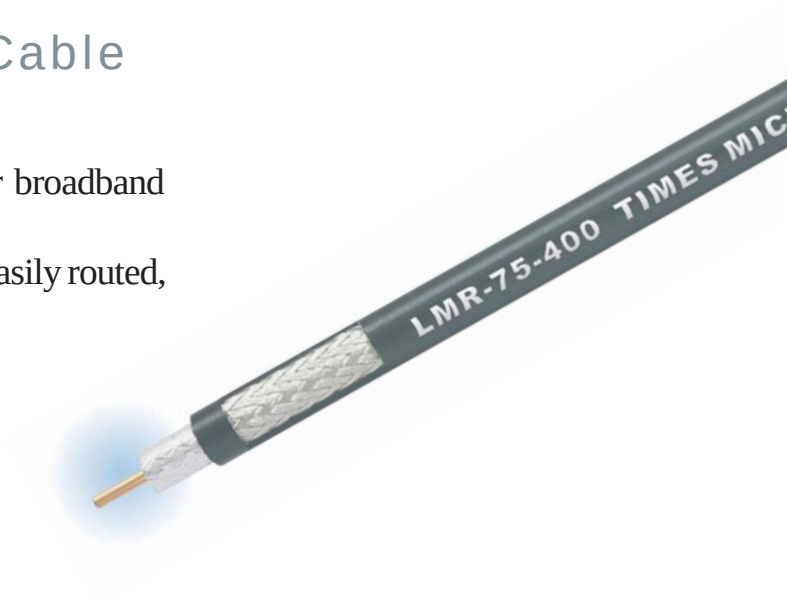
Type	Part Number	Stock Code	Description
Ground Kit	GK-S300TT	GK-S300TT	Standard Grounding Kit

TIMES MICROWAVE SYSTEMS

LMR®-400-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable



• **LMR®-75** standard 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.

• **Flexibility** and bendability are hallmarks of the LMR-400-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-400-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies**: All LMR-400-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-400-75	Indoor/Outdoor	PE	Black	54147
LMR-400-75-DB	Outdoor	PE	Black	54228

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.065	(1.65)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Black PE	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.068	(0.10)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

Environmental Specifications

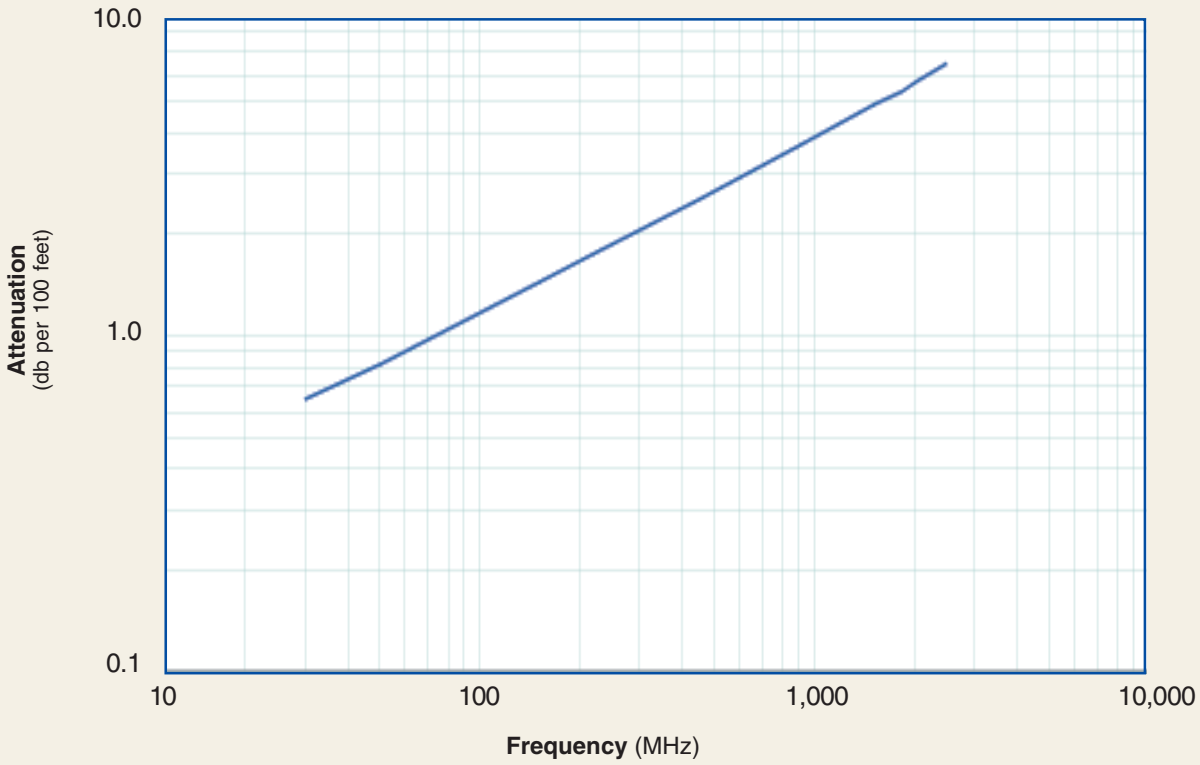
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

TIMES MICROWAVE SYSTEMS

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	15.9	(52.3)
Inductance	uH/ft (uH/m)	0.090	(0.29)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.50	(8.20)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.6	0.8	1.5	1.8	2.6	3.7	4.9	5.4	5.7	6.4
Attenuation dB/100 m	2.1	2.7	4.8	5.8	8.4	12.1	16.0	17.6	18.7	21.1
Avg. Power kW	2.99	2.31	1.32	1.08	0.74	0.52	0.39	0.35	0.33	0.30

Calculate Attenuation =
$(0.115570) \bullet \sqrt{FMHz} + (0.000260) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR®-400-75 Ohm
Flexible Low Loss Coaxial Cable


EZ-400-FMH-75


EZ-400-FM-75


TC-400-NM-75


EZ-400-NM-75


TC-400-NM-75/50

Connectors

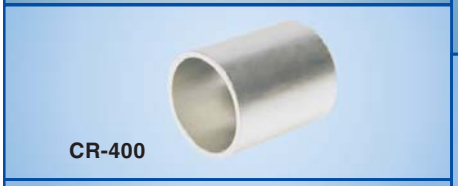
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F Male	Straight Plug	EZ-400-FMH-75	3190-1617	<1.25:1 (2.0)	Hex	Spring Finger	Crimp	N/G	1.7 (42.9)	0.49 (12.4)	0.02 (9.07)
	Straight Plug	EZ-400-FM-75	3190-952	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/G	1.7 (43.2)	0.56 (14.2)	0.002 (9.1)
N Male	Straight Plug	EZ-400-NM-75	3190-1618	<1.25:1 (2.0)	Knurl	Spring Finger	Crimp	N/G	2.0 (50.5)	0.81 (20.6)	0.10 (45.36)
	Straight Plug	TC-400-NM-75	3190-389	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5 (38.1)	0.83 (21.1)	0.90 (40.8)
	Straight Plug	TC-400-NM-75/50	3190-1704	<1.25:1 (2.0)	Knurl	Solder	Crimp	N/G	1.5 (38.1)	0.83 (21.1)	0.09 (39.01)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

HX-4

Y1719

CT-400/300


CR-400


ST-400EZ


DBT-01


CCT-01


TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch


GK-S400TT


HG-400T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400TT	GK-S400TT	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)

TIMES MICROWAVE SYSTEMS

LMR®-600-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable

• **LMR®-75** standard 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.

• **Flexibility** and bendability are hallmarks of the LMR-600-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: LMR-600-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies**: All LMR-600-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-600-75	Indoor/Outdoor	PE	Black	54148
LMR-600-75-DB	Outdoor	PE	Black	54220

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.108	(2.74)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Black PE	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.131	(0.20)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

Environmental Specifications

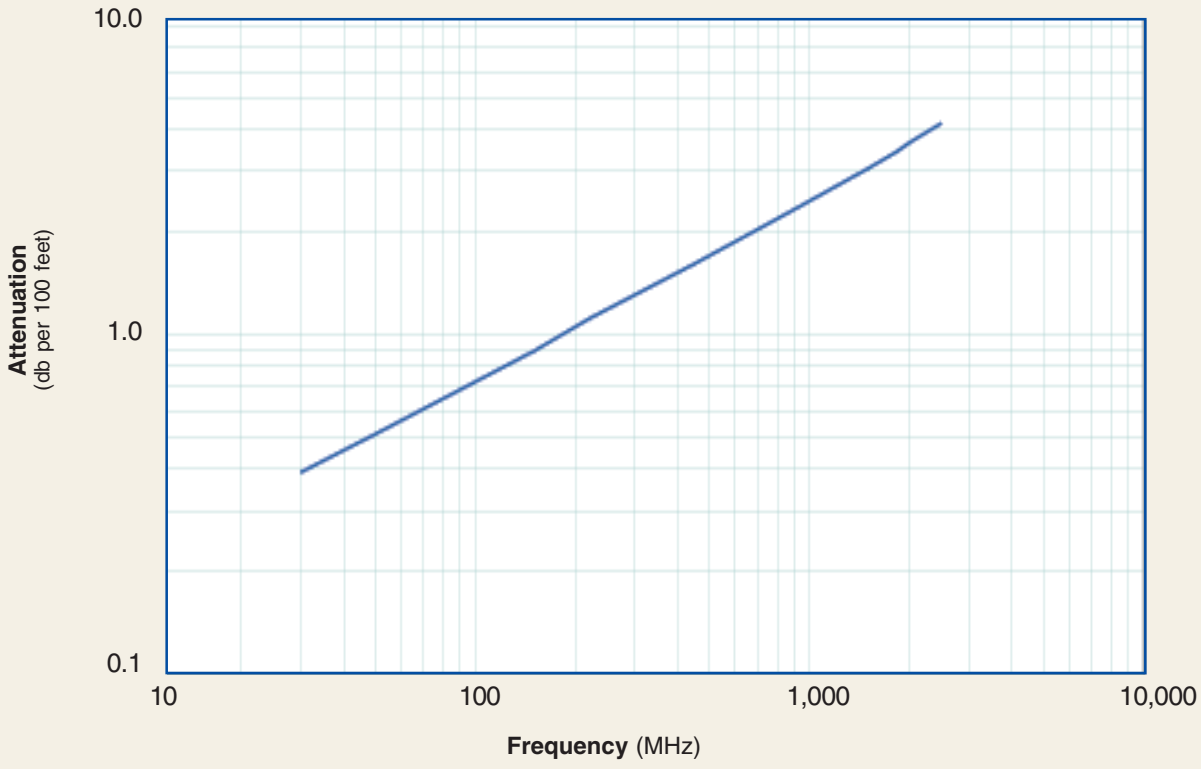
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

TIMES MICROWAVE SYSTEMS

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	15.6	(51.1)
Inductance	uH/ft (uH/m)	0.088	(0.29)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.56)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.4	0.5	0.9	1.1	1.6	2.3	3.1	3.5	3.7	4.2
Attenuation dB/100 m	1.3	1.7	3.0	3.6	5.3	7.7	10.2	11.4	12.1	13.7
Avg. Power kW	4.77	3.67	2.08	1.70	1.16	0.80	0.60	0.54	0.51	0.45

Calculate Attenuation =
$(0.070590) \bullet \sqrt{FMHz} + (0.000260) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

LMR-600-75 Ohm
Flexible Low Loss Coaxial Cable


EZ-600-FMH-75


EZ-600-NM-75


TC-600-NMH-75/50

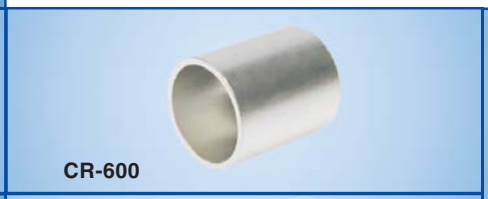
Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F Male	Straight Plug	EZ-600-FMH-75	3190-1619	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	N/G	1.7 (43.2)	0.56 (14.2)	0.112(50.8)
N Male	Straight Plug	EZ-600-NM-75	3190-1620	<1.25:1 (2.0)	Knurl	Spring Finger	Crimp	N/G	2.1 (53.1)	0.87 (22.1)	0.166 (75)
	Straight Plug	TC-600-NMH-75/50	3190-1610	<1.25:1 (2.0)	Hex	Solder	Crimp	N/G	2.1 (53.1)	0.83 21.1	0.166 (75)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

HX-4

Y1720


CR-600


ST-600EZ


DBT-01

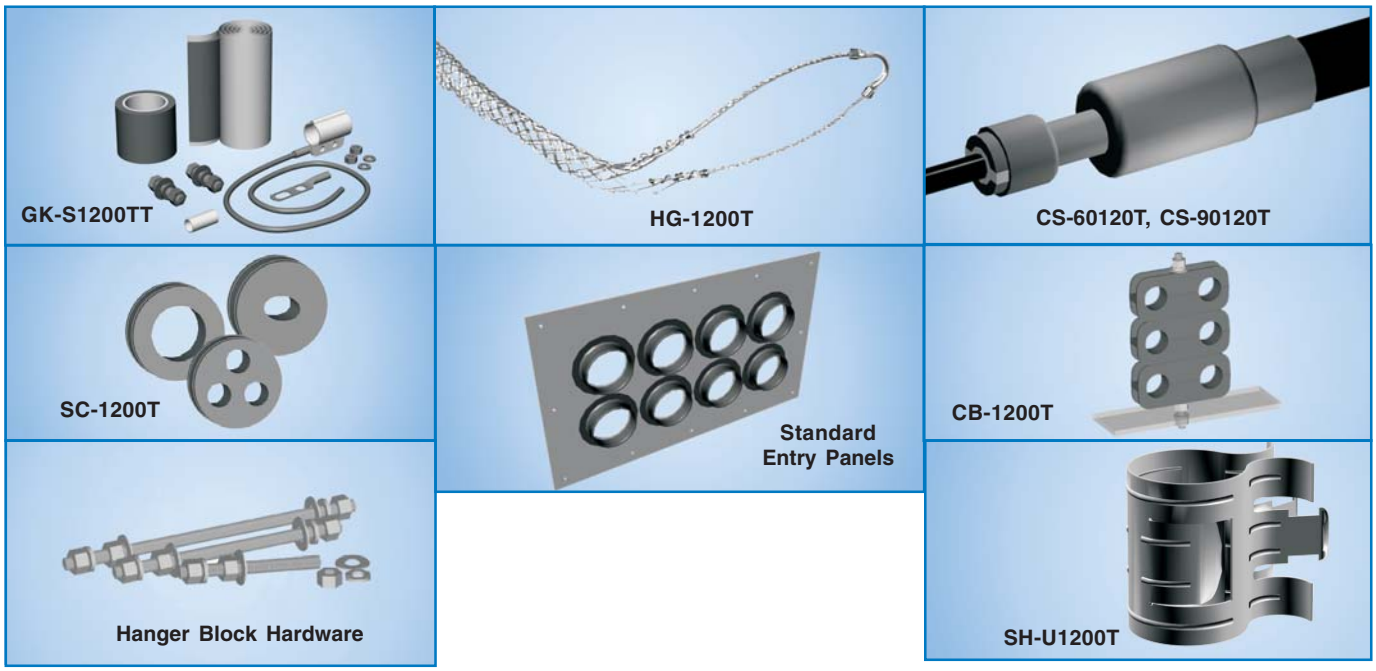
GST-600A

TK-600EZ


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Stand. Entry Port Cushion	SC-600T	SC-600T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

TCOM®-195
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-195	Outdoor	PE	Black	55021
TCOM-195-FR	Indoor-Riser CMR	FRPE	Black	55012

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any air-dielectric and corrugated hard-line cables. **TCOM®- FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

Flexibility and bendability are hallmarks of the TCOM-195 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-195. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications.

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-195 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-195 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-195 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

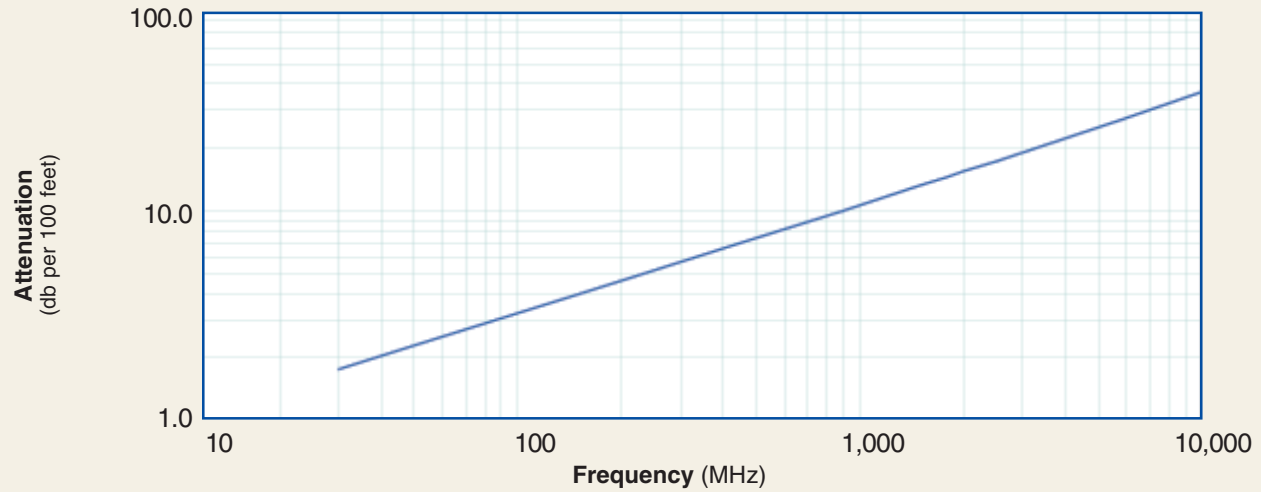
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Foam PE	0.110	(2.79)
Outer Conductor	SPC Strip Braid	0.120	(3.05)
Overall Braid	TC Braid over Al tape	0.148	(3.76)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.035	(0.05)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

Environmental Specifications		
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	25.4	(83.3)
Inductance	uH/ft (uH/m)	0.064	(0.21)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.6	(24.9)
Outer Conductor	ohms/1000ft (/km)	3.42	(11.2)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.8	2.3	4.0	4.9	7.0	10.1	13.1	14.5	15.3	17.2	27.2	36.8
Attenuation dB/100 m	5.8	7.5	13.1	16.0	23.0	33.0	43.1	47.5	50.2	56.5	89.1	120.7
Avg. Power kW	0.91	0.71	0.40	0.33	0.23	0.16	0.12	0.11	0.10	0.09	0.06	0.04

Calculate Attenuation = (0.321011) • $\sqrt{\text{FMHz}}$ + (0.000469) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5	(38.1)	0.75	(19.1)	0.073	(33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.015	(6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4	(35.6)	0.59	(15.0)	0.045	(20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Accessories

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

TCOM®-200
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®-FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

Flexibility and bendability are hallmarks of the TCOM-200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-200. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-200 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-200	Outdoor	PE	Black	55001
TCOM-200-FR	Indoor-Riser CMR	FRPE	Black	55022

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	SPC Strip Braid	0.126	(3.20)
Overall Braid	TC Braid over Al tape	0.154	(3.91)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.040	(0.06)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

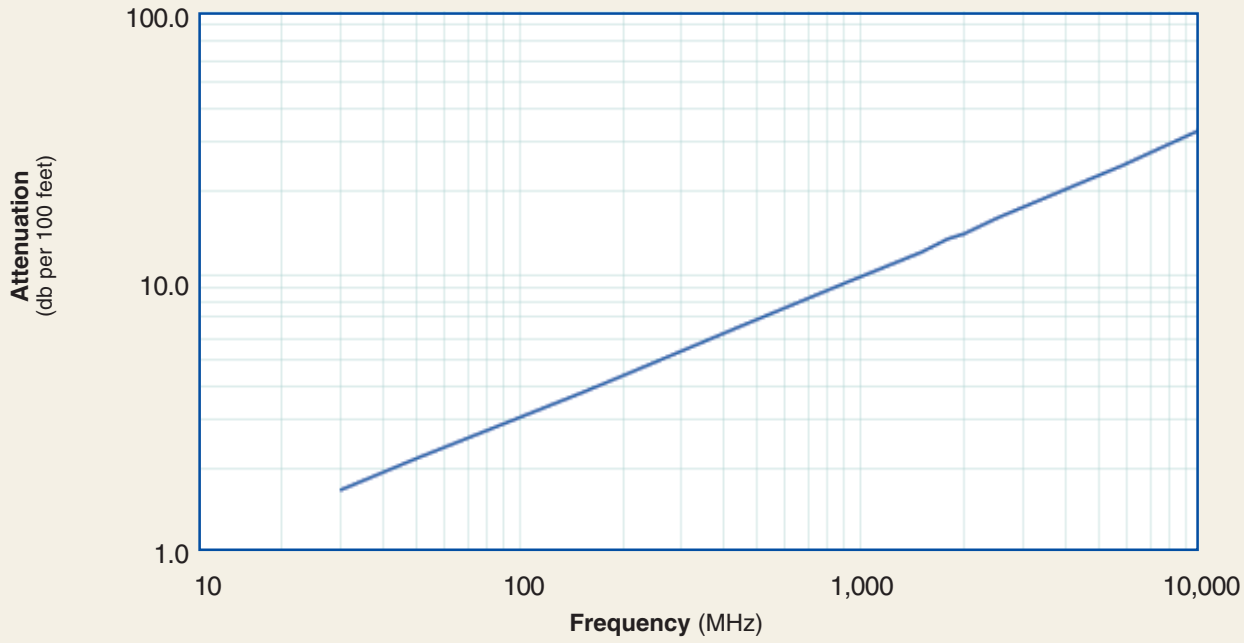
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	3.84	(12.6)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency **(typical)**

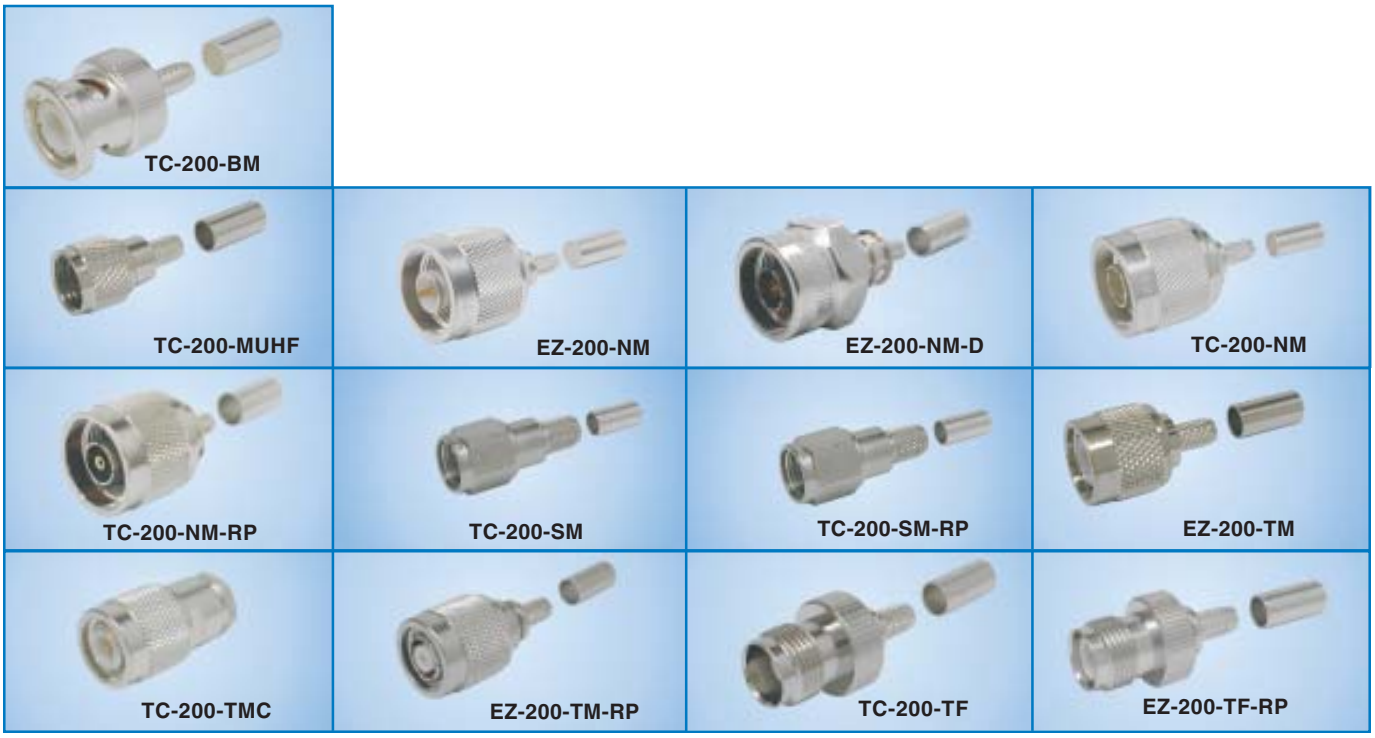


Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.7	2.2	3.8	4.6	6.6	9.4	12.3	13.5	14.2	16.0	25.0	33.7
Attenuation dB/100 m	5.5	7.1	12.4	15.0	21.6	30.9	40.2	44.2	46.7	52.5	82.2	110.5
Avg. Power kW	1.08	0.84	0.48	0.39	0.27	0.19	0.15	0.13	0.13	0.11	0.07	0.05

Calculate Attenuation = (0.303670) • $\sqrt{\text{FMHz}}$ + (0.000331) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

TCOM-200
Low Loss Low Passive Intermod Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
BNC male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	SG	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)
N male	Straight Plug	EZ-200-NM	3190-1475	<1.25:1 (8)	Knurl	Spring Fit	Crimp	SG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
N male	Straight Plug	EZ-200-NM-D	3190-1918	<1.25:1 (8)	Hex/Knurl	Spring Fit	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
N male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	SG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
N male	Reverse Polarity	TC-200-NM-RP	3190-959	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	NG	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
TNC female	Reverse Polarity	EZ-200-TF-RP	3190-793	<1.25:1 (2.5)	NA	Spring Fit	Crimp	AG	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
TNC male	Straight Plug	EZ-200-TM	3190-1266	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	SG	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)
TNC male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	SG	1.7 (43.2)	0.59 (15.0)	0.045 (20.4)
TNC male	Reverse Polarity	EZ-200-TM-RP	3190-792	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	AG	1.4 (35.6)	0.32 (8.1)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

GK-S200TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200TT	GK-S200TT	Standard Ground Kit (each)

CT240/200/195/100

Install Tools

CCT-01

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

TCOM®-240
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®- FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

TCOM®- PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-240 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-240. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-240 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-240 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-240 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-240	Outdoor	PE	Black	55017
TCOM-240-FR	Indoor-Riser CMR	FRPE	Black	55023

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.056	(1.42)
Dielectric	Foam PE	0.150	(3.81)
Outer Conductor	SPC Strip Braid	0.160	(4.06)
Overall Braid	TC Braid over Al tape	0.188	(4.78)
Jacket	(see table above)	0.240	(6.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.045	(0.07)
Tensile Strength	lb (kg)	80	(36.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

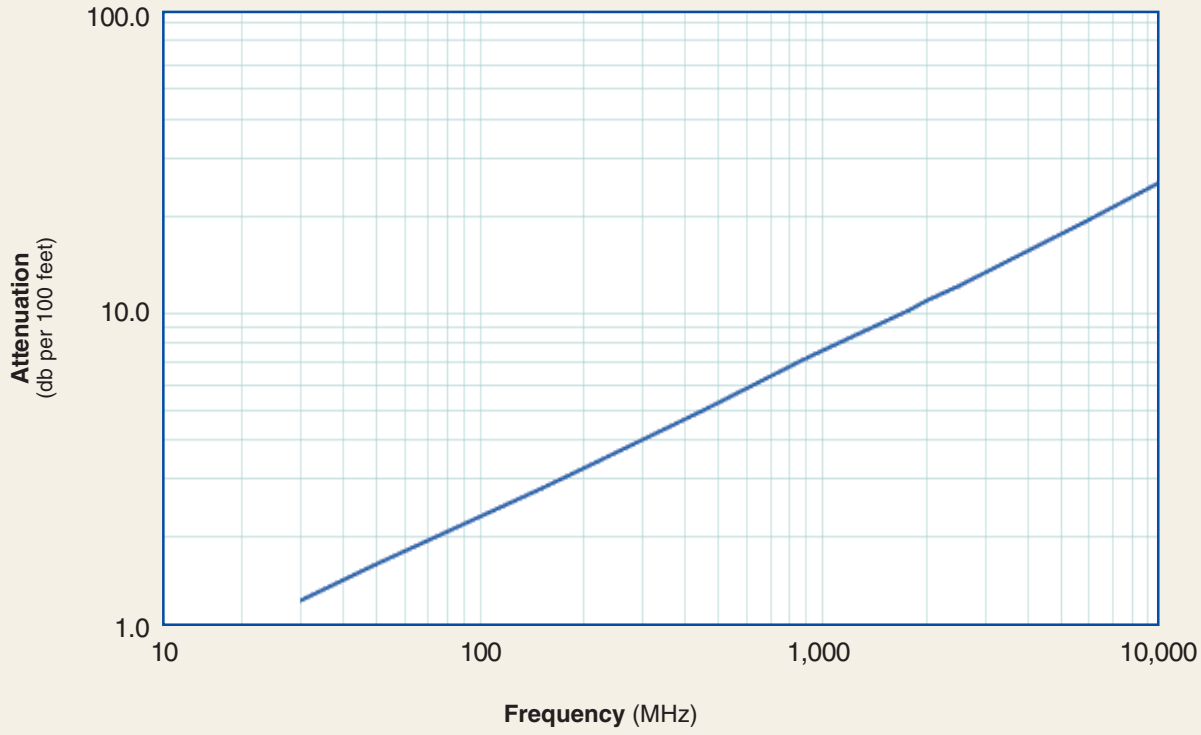
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	31	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	3.2	(10.5)
Outer Conductor	ohms/1000ft (/km)	2.06	(6.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.3	1.6	2.9	3.5	5.0	7.2	9.4	10.3	10.9	12.3	19.4	26.2
Attenuation dB/100 m	4.2	5.4	9.4	11.4	16.4	23.5	30.7	33.9	35.8	40.3	63.6	86.0
Avg. Power kW	1.58	1.22	0.70	0.57	0.40	0.28	0.21	0.19	0.18	0.16	0.10	0.07

Calculate Attenuation =
$(0.229148) \bullet \sqrt{FMHz} + (0.000331) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

TCOM-240
Low Loss Low Passive Intermod Coax

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43)	0.56	(14.2)	0.040	(18.1)
BNC Male	Straight Plug	TC-240-BM(A)	3190-867	<1.25:1 (2.5)	Knurl	Solder	Crimp	A/G	1.7	(43)	0.56	(14.2)	0.043	(19.5)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.45	(11.4)	0.014	(6.4)
N Male	Straight Plug	EZ-240-NM-D	3190-1127	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Crimp	N/G	1.5	(38.1)	0.78	(19.8)	0.086	(39.0)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	N/S	1.5	(38)	0.75	(19.1)	0.086	(39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5	(38)	0.75	(19.1)	0.082	(37.2)
N Male	Right Angle	TC-240-NM-RA(A)	3190-868	<1.35:1 (2.5)	Hex	Solder	Crimp	A/G	1.3	(33)	1.14	(29.1)	0.105	(47.6)
N Female	Panel Jack	TC-240-NF-BHF(A)	3190-866	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7	(44)	0.88	(22.2)	0.115	(52.2)
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25:1 (2.5)	NA	Solder	Clamp	A/G	1.8	(46)	0.8 8	(22.4)	0.145	(65.8)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1	(29)	0.31	(7.9)	0.019	(8.6)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8	(20)	0.65	(16.5)	0.019	(8.6)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
TNC Male	Straight Plug	EZ-240-TM	3190-1128	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/G	1.4	(34.3)	0.59	(15.0)	0.043	(19.5)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.043	(19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.3	(33)	0.57	(14.5)	0.055	(24.9)
TNC Male	Reverse Polarity	EZ-240-TM-RP	3190-970	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	1.4	(36)	0.59	(15.0)	0.043	(19.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

GK-S240TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240TT	GK-S240TT	Standard Ground Kit (each)

ST-240EZ

CT-240/200/195/100

CCT-01

Installation Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Strip Tool	ST-240-EZ	3190-1880	Strip tool for EZ connectors
Deburr Tool	DBT-02	3190-1706	Removes center concuctor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

TCOM®-300
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®- FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

TCOM®- PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-300 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-300. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-300 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-300 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-300 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
TCOM-300	Outdoor	PE	Black	55011
TCOM-300-FR	Indoor-Riser CMR	FRPE	Black	55013

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.070	(1.78)
Dielectric	Foam PE	0.190	(4.83)
Outer Conductor	SPC Strip Braid	0.200	(5.08)
Overall Braid	TC Braid over Al tape	0.234	(5.94)
Jacket	(see table above)	0.300	(7.62)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.88	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

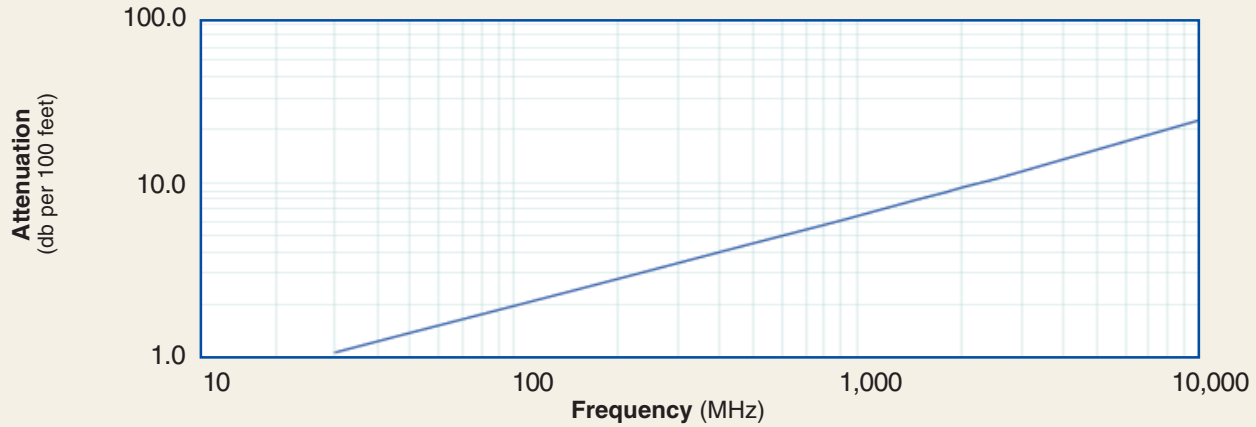
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	24.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.12	(7.0)
Outer Conductor	ohms/1000ft (/km)	2.10	(6.9)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.1	1.4	2.4	3.0	4.3	6.1	8.0	8.8	9.3	10.5	16.7	22.7
Attenuation dB/100 m	3.5	4.6	8.0	9.7	14.0	20.1	26.3	29.0	30.7	34.6	54.8	74.5
Avg. Power kW	2.07	1.60	0.91	0.75	0.52	0.36	0.28	0.25	0.24	0.21	0.13	0.10

Calculate Attenuation = (0.194337) • $\sqrt{\text{FMHz}}$ + (0.000327) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-300-NM


TC-300-NM-RA


TC-300-TM


TC-300-NM-RA-(A)


TC-300-SF-BH


TC-300-SM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)		Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1	(6)	Knurl	Solder	Crimp	N/S	1.6	(41)	0.85	(21.6)	0.074	(33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1	(2.5)	Knurl	Solder	Crimp	N/S	1.5	(38)	0.85	(21.6)	0.101	(45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1	(2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.050	(22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1	(2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.35	(8.9)	0.018	(8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1	(2.5)	NA	Solder	Crimp	SS/G	1.1	(28)	0.31	(7.9)	0.022	(10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300TT	GK-S300TT	Standard Ground Kit (each)


GK-S300TT


CT-300/400

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR-300 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CCT-01

TIMES MICROWAVE SYSTEMS

TCOM®-400
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®- FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

TCOM®- PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-400 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-400. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications.

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-400 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-400 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-400 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-400	Outdoor	PE	Black	55003
TCOM-400-FR	Indoor-Riser CMR	FRPE	Black	55016
TCOM-400-PUR	Indoor/Outdoor	PUR	Black	55015

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.108	(2.74)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	SPC Strip Braid	0.295	(7.49)
Overall Braid	TC Braid over Al tape	0.330	(8.38)
Jacket	(see table above)	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.00	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.080	(0.12)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

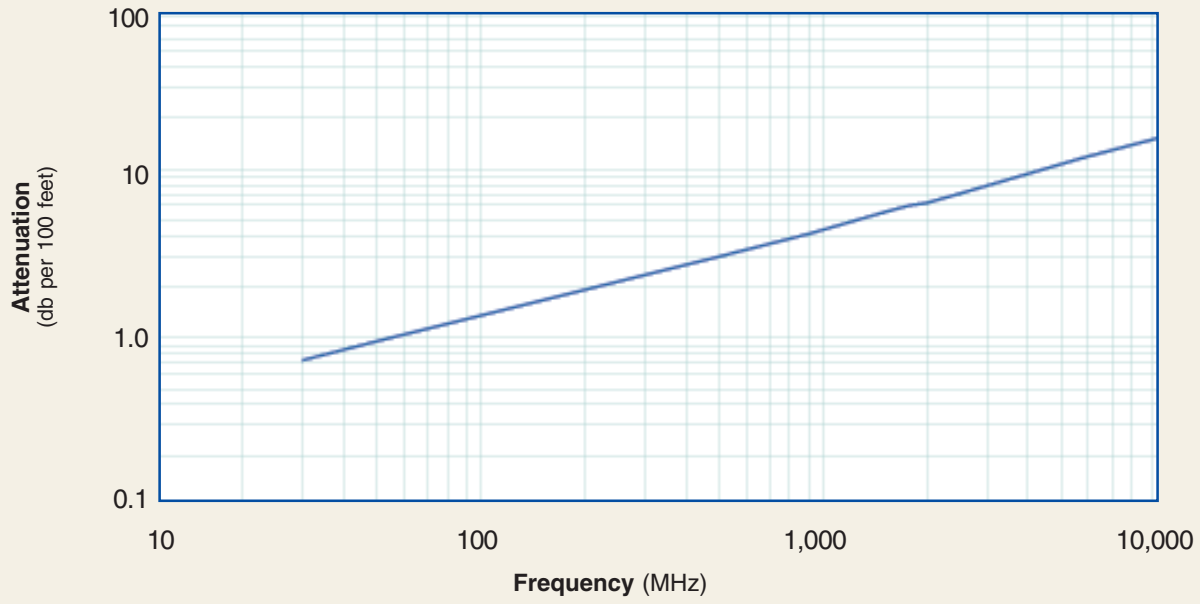
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	16.2	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.6)
Outer Conductor	ohms/1000ft (/km)	1.47	(4.8)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	0.7	0.9	1.6	2.0	2.9	4.2	5.4	6.0	6.4	7.2	11.5	15.7
Attenuation dB/100 m	2.4	3.1	5.4	6.5	9.5	13.6	17.9	19.7	20.9	23.6	37.6	51.4
Avg. Power kW	3.12	2.41	1.38	1.13	0.78	0.54	0.41	0.37	0.35	0.31	0.19	0.14

Calculate Attenuation =
$(0.130555) \bullet \sqrt{FMHz} + (0.000262) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

TCOM-400
Low Loss Low Passive Intermod Coax

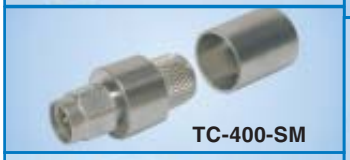
Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Female	Straight Jack	TC-400-716-FC	3190-376	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	1.6	(41)	1.13	(28.7)	0.281	(127.5)
7-16 DIN Male	Straight Plug	TC-400-716-MC	3190-279	<1.25:1 (2.5)	Hex	Solder	Clamp	S/S	1.4	(36)	1.40	(35.6)	0.268	(121.6)
BNC Male	Straight Plug	TC-400-BM	3190-318	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.56	(14.2)	0.063	(28.6)
Mini-UHF	Straight Plug	TC-400-MUHF	3190-520	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.50	(12.7)	0.020	(9.1)
N Female	Straight Jack	TC-400-NFC	3190-299	<1.25:1 (2.5)	NA	Solder	Clamp	N/S	1.6	(41)	0.75	(19.1)	0.119	(54.0)
	Straight Jack	EZ-400-NF	3190-956	<1.25:1 (2.5)	NA	Spring Finger	Crimp	N/G	1.8	(45)	0.66	(16.8)	0.105	(47.6)
	Bulkhead Jack	EZ-400-NF-BH	3190-518	<1.25:1 (2.5)	NA	Spring Finger	Crimp	N/G	1.8	(46)	0.88	(22.4)	0.102	(46.3)
	Bulkhead Jack	TC-400-NFC-BH (A)	3190-872	<1.25:1 (2.5)	NA	Solder	Clamp	A/G	1.8	(46)	0.8 8	(22.4)	0.145	(65.8)
N Male	Straight Plug	SC-400-NM	3190-1454	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
	Straight Plug	TC-400-NM	3190-188	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
	Straight Plug	TC-400-NMC	3190-277	<1.25:1 (2.5)	Knurl	Solder	Clamp	N/G	1.5	(38)	0.75	(19.1)	0.121	(54.9)
	Straight Plug	EZ-400-NFC-2	3190-1907	<1.25:1 (2.5)	NA	Spring Finger	Clamp	N/S	1.5	(38)	0.75	(19.1)	0.121	(54.9)
	Straight Plug	EZ-400-NMC-2	3190-1906	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Clamp	N/S	1.5	(38)	0.75	(19.1)	0.121	(54.9)
	Straight Plug	EZ-400-NMH-D	3190-400	<1.25:1 (10)	Hex/Knurl	Spring Finger	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.113	(51.3)
	Straight Plug	TC-400-NMH	3190-552	<1.25:1 (10)	Hex	Solder	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.113	(51.3)
	Straight Plug	EZ-400-NMK	3190-661	<1.25:1 (10)	Knurl	Spring Finger	Crimp	S/G	1.5	(38)	0.89	(22.6)	0.113	(51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (2.5)	Hex	Solder	Crimp	S/G	1.8	(46)	1.25	(31.8)	0.130	(59.0)
	Right Angle	TC-400-NMC-RA (A)	3190-870	<1.35:1 (2.5)	Hex	Solder	Clamp	A/G	1.8	(46)	1.2 5	(31.8)	0.150	(68.0)
	Right Angle	EZ-400-NMH-RA	3190-761	<1.25:1 (6)	Hex	Spring Finger	Crimp	S/G	1.8	(46)	1.25	(31.8)	0.130	(59.0)
	Reverse Polarity	TC-400-NM-RP	3190-960	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38)	0.75	(19.1)	0.090	(40.8)
SMA Male	Straight Plug	TC-400-SM	3190-439	<1.25:1 (8)	Hex	Solder	Crimp	N/G	1.2	(29)	0.50	(12.7)	0.032	(14.5)
TNC Female	Reverse Polarity	EZ-400-TF-RP	3190-795	<1.25:1 (2.5)	NA	Spring Finger	Crimp	A/G	1.8	(46)	0.55	(14.0)	0.074	(33.6)
TNC Male	Straight Plug	TC-400-TM	3190-260	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.074	(33.6)
	Straight Plug	EZ-400-TM	3190-650	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.074	(33.6)
	Right Angle	TC-400-TM-RA	3190-442	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.7	(43)	0.59	(15.0)	0.085	(38.6)
	Reverse Polarity	EZ-400-TM-RP	3190-794	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	1.7	(43)	0.59	(15.0)	0.074	(33.6)
UHF Male	Straight Plug	EZ-400-UM	3190-997	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	N/G	1.9	(48)	0.80	(20.3)	0.090	(40.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


EZ-400-TM


TC-400-TM-RA


TC-400-SM


TC-400-BM


TC-400-716MC


TC-400-716FC


EZ-400-TM-RP


EZ-400-TF-RP


TC-400-MUHF


EZ-400-UM


HG-400T


GK-S400TT

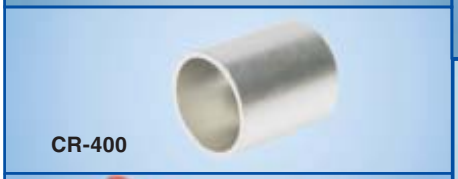
Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400TT	GK-S400TT	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)


HX-4


Y1719


CT-400/300


CR-400


ST-400C, ST-400EZ


DBT-01


CCT-01


ST-400C-2


TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	Prep tool for all LMR-400 clamp style connectors except EZ-400-NMC-2
Strip Tool	ST-400C-2	3190-1972	Prep tool for EZ-400-NMC-2 two piece clamp style connector
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

TCOM®-500
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®-FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

TCOM®-PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-500 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-500. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications.

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-500 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-500 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-500 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
TCOM-500	Outdoor	PE	Black	55004
TCOM-500-FR	Indoor-Riser CMR	FRPE	Black	55025

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.142	(3.61)
Dielectric	Foam PE	0.370	(9.40)
Outer Conductor	SPC Strip Braid	0.380	(9.65)
Overall Braid	TC Braid over Al tape	0.415	(10.54)
Jacket	(see table above)	0.500	(12.70)

Mechanical Specifications

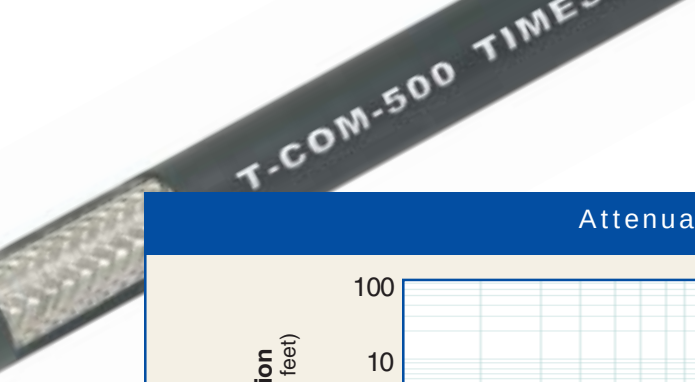
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.120	(0.179)
Tensile Strength	lb (kg)	260	(118.0)
Flat Plate Crush	lb/in. (kg/mm)	50	(0.89)

Environmental Specifications

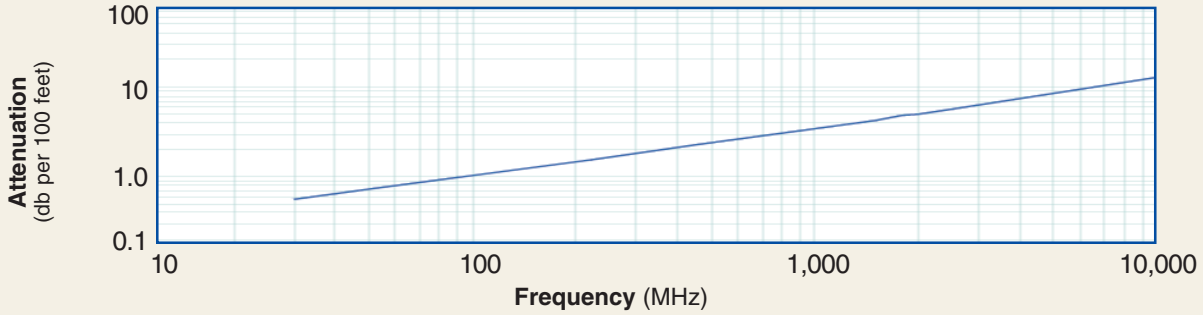
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	12.6	
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.88)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.6	(77.5)
Inductance	uH/ft (uH/m)	0.059	(0.19)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.82	(2.7)
Outer Conductor	ohms/1000ft (/km)	1.32	(4.3)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	22	
Passive Intermod	dBc	-155	



Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	0.6	0.7	1.3	1.6	2.3	3.3	4.3	4.8	5.0	5.7	9.2	12.7
Attenuation dB/100 m	1.8	2.4	4.2	5.1	7.4	10.7	14.1	15.6	16.5	18.7	30.2	41.7
Avg. Power kW	4.21	3.25	1.85	1.52	1.04	0.72	0.55	0.49	0.47	0.41	0.25	0.18

Calculate Attenuation = (0.100972) • $\sqrt{\text{FMHz}}$ + (0.000262) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)		Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	(mm)	Width in	(mm)	Weight lb	(g)
N Male	Straight Plug	TC-500-NMC	3190-377	<1.25:1	(2.5)	Hex	Solder	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.228	(103.4)
	Right Angle	TC-500-NMC-RA	3190-227	<1.35:1	(2.5)	Hex	Solder	Clamp	S/G	2.4	(61)	1.5	(38.1)	0.275	(124.7)
N Female	Straight Jack	TC-500-NFC	3190-215	<1.25:1	(2.5)	NA	Solder	Clamp	S/G	2.2	(56)	0.94	(23.9)	0.215	(97.5)
	Bulkhead Kit	BHA-KIT	3190-223	<1.25:1	(2.5)	NA	NA	NA	NA	NA	NA	NA	NA	0.014	(6.4)
TNC Male	Straight Plug	TC-500-TM	3190-464	<1.25:1	(2.5)	Hex	Solder	Crimp	N/G	1.5	(38)	0.62	(15.7)	0.082	(28.1)
UHF Male	Straight Plug	TC-500-UMC	3190-354	<1.25:1	(2.5)	Knurl	Solder	Clamp	S/G	2.1	(53)	0.88	(22.4)	0.215	(97.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

TCOM®-600
Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®- FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively.

TCOM®- PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-600. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than –155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

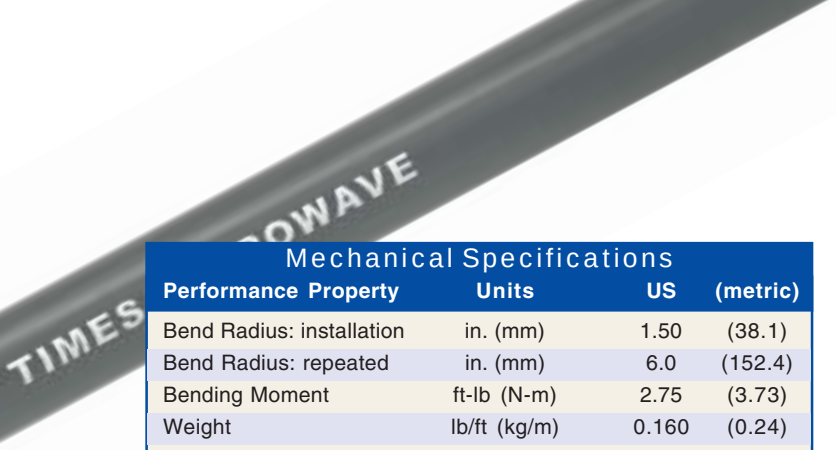
Weatherability: TCOM-600 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-600	Outdoor	PE	Black	55005
TCOM-600-FR	Indoor-Riser CMR	FRPE	Black	55018
TCOM-600-PUR	Indoor/Outdoor	PUR	Black	55006

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	SPC Strip Braid	0.465	(11.81)
Overall Braid	TC Braid over Al tape	0.500	(12.70)
Jacket	(see table above)	0.590	(14.99)



Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.160	(0.24)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

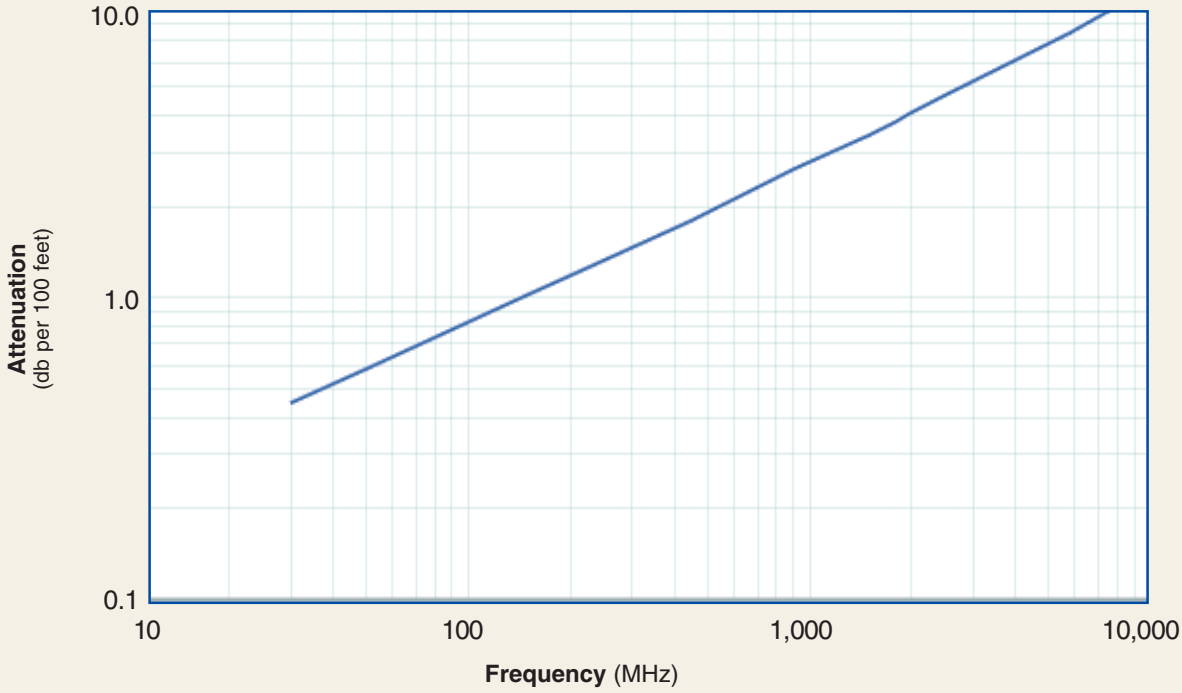
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	10.3	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.53	(1.74)
Outer Conductor	ohms/1000ft (/km)	1.52	(5.0)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	0.4	0.6	1.0	1.2	1.8	2.6	3.5	3.9	4.1	4.6	7.6	10.6
Attenuation dB/100 m	1.5	1.9	3.3	4.1	6.0	8.6	11.4	12.7	13.4	15.2	24.9	34.7
Avg. Power kW	5.20	4.01	2.28	1.86	1.28	0.88	0.66	0.60	0.56	0.50	0.30	0.22

Calculate Attenuation =
$(0.080075) \bullet \sqrt{FMHz} + (0.000256) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

TCOM-600
Low Loss Low Passive Intermod Coax

600 Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Female	Straight Jack	TC-600-716-FC	3190-375	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	1.1	(28)	1.00	(25.4)	0.249	(112.9)
7-16 DIN Male	Straight Plug	EZ-600-716-MH	3190-503	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/S	2.0	(51)	1.30	(33.0)	0.254	(115.2)
	Straight Plug	TC-600-716-MC	3190-502	<1.25:1 (2.5)	Hex	Solder	Clamp	S/S	2.0	(51)	1.30	(33.0)	0.347	(157.4)
	Right Angle	TC-600-716M-RA	3190-395	<1.35:1 (2.5)	Hex	Solder	Crimp	S/S	1.4	(36)	1.40	(35.6)	0.354	(160.8)
7/8 EIA	Flange	TC-600-78EIA	3190-321	<1.25:1 (2.5)	NA	Solder	Clamp	S/S	2.3	(58)	2.60	(66.0)	0.873	(396.0)
N Female	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (2.5)	NA	Spring Finger	Crimp	S/G	2.4	(61)	0.88	(22.4)	0.195	(88.5)
	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1 (2.5)	NA	Solder	Crimp	S/G	2.4	(61)	0.88	(22.4)	0.195	(88.5)
	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2	(56)	0.94	(23.9)	0.214	(97.1)
N Male	Straight Plug	EZ-600-NMH-D	3190-1268	<1.25:1 (8.0)	Hex/Knurl	Spring Finger	Crimp	A/G	2.1	(53)	0.92	(23.4)	0.164	(74.4)
	Straight Plug	EZ-600-NMC	3190-355	<1.25:1 (2.5)	Hex	Spring Finger	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.202	(91.6)
	Straight Plug	EZ-600-NMC-2	3190-1387	<1.25:1 (6.0)	Hex/Knurl	Spring Finger	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.202	(91.6)
	Straight Plug	TC-600-NMC	3190-357	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.208	(93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.1	(53)	0.92	(23.4)	0.280	(17.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	S/G	2.1	(53)	0.92	(23.4)	0.185	(83.9)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	1.7	(43)	0.59	(15.0)	0.112	(50.8)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	1.7	(43)	0.88	(22.4)	0.164	(74.4)
	Straight Plug	TC-600-UMC	3190-213	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43)	0.88	(22.4)	0.198	(89.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S600TT


HG-600T


CS-A600T, CS-60120T, CS-60170T


SC-600T


CB-600T


Hanger Block Hardware

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Standard Entry Port Cushion	SC-600T	SC-600T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available


HX-4


DBT-01


Y1720


ST-600C, ST-600EZ


WR-600

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	Standard .610" Hex
Strip Tool	ST-600C	3190-230	For Clamp Style Connectors
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Wrench	WR600	3190-1435	15/16" Box Wrench (2 required for EZ-600-NMC-2)

TIMES MICROWAVE SYSTEMS

Installation Tools

Crimp Tools


HX-4


Y1719


CT-400/300

Strip Tools


ST-240EZ


ST-400C


ST-400C-2


ST-600C


ST-900/1200C


ST-1700C

Part No.	Stock Code	Description	Qty
HX-4	3190-200	Crimp Tool (handle only)	each
Y197	3190-610	.213" hex dies fo TC/EZ-195/200 crimp connectors	each
Y375	3190-608	.255" hex dies for TC/EZ-240 crimp connectors	each
Y102	3190-611	.324" hex dies for TC/EZ-300 crimp connectors	each
Y1719	3190-202	.429" hex dies for TC/EZ-400 crimp connectors	each
Y151	3190-465	.532" hex dies for TC/EZ-500 crimp connectors	each
Y1720	3190-203	.610" hex dies for TC/EZ-600 crimp connectors	each
CT-400/300	3190-666	Crimp tool for LMR-400 & LMR-300 connectors	each
CT-240/200/100	3190-667	Crimp tool for LMR-240, LMR-200, LMR195 & LMR-100 connectors	each
ST-240EZ	3190-1880	Prep tool for LMR-240 EZ Connectors	each
ST-400C	3190-228	Prep tool for all LMR-400 clamp style connectors except EZ-400-MNC-2	each
ST-400C-2	3190-1972	Prep tool for EZ-400-NMC-2 & EZ-400-NFC-2 two piece clamp style connectors	each
ST-400EZ	3190-401	Prep tool for TC/EZ LMR-400 crimp style connectors	each
ST-500C	3190-229	Prep tool for LMR-500 clamp style connectors	each
ST-600C	3190-230	Prep tool for LMR-600 clamp style connectors	each
ST-600EZ	3190-310	Prep tool for LMR-600 crimp style connectors	each
ST-900/1200C	3190-311	Prep tool for LMR-900 & 1200 clamp style connectors	each
ST-900C	3190-1310	Prep tool for LMR-900 clamp style connectors	each
ST-1200C	3190-1311	Prep tool for LMR-1200 clamp style connectors	each
ST-1700C	3190-312	Prep tool for LMR-1700 clamp style connectors	each
RB-456	3190-421	Replacement blades for ST-400, 500 & 600 (pkg of 2; 1 each end-1 & end-2)	each

Midspan Strip Tools


GST-600A

Deburring Tools


DBT-01

DBT-02

Wrenches


WR-1200A, WR1200B

Tool Kits


TK-400EZ

Cable End Cutting Tools

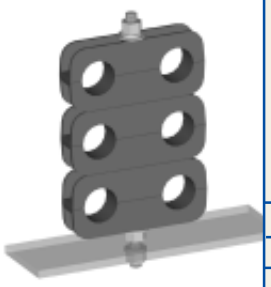

CCT-01

Part No.	Stock Code	Description	Qty
GST-600A	3190-1051	Midspan strip tool for LMR-600 grounding kit	each
GST-900A	3190-435	Midspan strip tool for LMR-900 grounding kit	each
GST-1200A	3190-436	Midspan strip tool for LMR-1200 grounding kit	each
GST-1700A	3190-437	Midspan strip tool for LMR-1700 grounding kit	each
DBT-01	3190-406	Deburring tool for LMR-400, 500 & 600 center conductors	each
DBT-02	3190-1706	Deburring tool for LMR-200, 240 & 300 center conductors	each
WR-600	3190-1435	15/16" box wrench (two required for EZ-600-NMC-2)	each
WR-900	3190-509	1-1/4" box wrench (two required for EZ-900 connectors)	each
WR-1200A	3190-512	1-9/16" box wrench (one required for EZ-1200 connectors)	each
WR-1200B	3190-511	1-7/16" box wrench (one required for EZ-1200 connectors)	each
WR-1700	3190-514	2" box wrench (two required for EZ-1700 connectors)	each
TK-01	3190-731	Install tool kit for LMR-400/600 connectors (includes CCT-01, ST-400EZ, ST-600EZ, DBT-01, HX-4, .429" and .610"hex dies, tool pouch)	each
TK-400EZ	3190-1601	Tool kit for LMR-400 crimp connectors (includes CCT-01,ST-400EZ, CT-400/300, DBT-01, tool pouch)	each
TK-600EZ	3190-1602	Tool kit for LMR-600 crimp connectors (includes CCT-01,ST-600EZ, HX-4, Y1720, DBT-01, tool pouch)	each
CCT-01	3190-1544	Cable end flush cut tool (pkg of 1)	each
RB-01	3190-1609	Replacement blade for CCT-01	each

TIMES MICROWAVE SYSTEMS

Hardware Accessories

Mini Coax Support Blocks



Neatly stack coax into space saving bundles. Lower material cost by reducing hardware requirements.

Application:	Coax Support
Size:	1/2" to 1-1/4" coax
Design:	Two-run block hangers
Feature:	Compact coax bundles
Mounts to:	3/8" or 10mm threaded rod
Material:	Long glass polypropylene
Includes:	Blocks only
Order Sep.:	3/8" or 10mm mounting hardware kits

	TMS part no.	Quant/pkg.	Weight lb(kg)
Mini coax support block for LMR-600	CB-600T	10	1.2 (0.5)
Mini coax support block for LMR-900	CB-900T	10	1.2 (0.5)
Mini coax support block for LMR-1200	CB-1200T	10	1.2 (0.5)
Mini coax support block for LMR-1700 coax	CB-1700T	10	1.7 (0.8)

Mounting Hardware Kits for Coax Support Blocks and Hanger Clamps

Pre-cut galvanized threaded rod hardware kits for stacking and installing mini coax support blocks.

Application:	Coax Support
Size:	3/8"
Design:	1, 2, and 3-stack threaded rod kits
Feature:	Stacks coax blocks
Mounts to:	—
Material:	Galv. (3/8") or stainless steel (10mm)
Includes:	Threaded rod and hardware
Order Sep.:	Additional accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Hardware kit for LMR-600, 900, 1200 support blocks	HK-SSCB	10	1.8 (0.8)
Hardware kit for LMR-1700 support blocks	HK-SSCB-158	10	1.9 (0.9)
Hardware kit for mounting (2) mini coax support blocks for LMR-600, 900, 1200	HK-DSCB	10	2.3 (1.0)
Hardware kit for mounting (2) mini coax support blocks for LMR-1700	HK-DSCB-158	10	2.5 (1.1)
Hardware kit for mounting (3) mini coax support blocks for LMR-600, 900, 1200	HK-TSCB	10	2.8 (1.3)
Hardware kit for mounting (3) mini coax support blocks for LMR-1700	HK-TSCB-158	10	3.2 (1.5)

Adapter Bracket

Support coax blocks in wall mount applications.

Application:	Coax Support
Size:	7/16" (11.1mm) holes
Design:	Adapts hangers to flat surfaces
Feature:	Compact design
Mounts to:	—
Material:	Stainless steel
Includes:	Bracket
Order Sep.:	Additional accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Adaptor bracket	AB-CB	10	4.6 (2.1)

Stainless Steel Adapter Bracket

Adapt angled members for securing coax cables. Unique design easily converts to accommodate snap-in hangers.

Application:	Coax Support
Size:	7/16" (11.1mm) holes
Design:	Adapts hangers to flat surfaces
Feature:	Fits any bolt-on hanger style
Mounts to:	—
Material:	Hot dip galv. steel,
Includes:	Bracket
Order Sep.:	Additional accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Universal SST angle adapter	AB-CBH	1	2.3 (1.0)

Butterfly Hangers

Butterfly hangers for standard non-snap-in installations.

Application: Coax Support
Size: see chart
Design: Bolt-on single run hanger
Feature: Traditional hanger solution
Mounts to: 7/16" (11.1mm) prepunched hole
Material: Stainless steel
Includes: Hangers and set bolts
Order Sep.: Hanger hardware kits & additional accessories
Note: Hanger hardware kit not included; order separately

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Butterfly hanger for LMR-400	BH-S38 NH	10	1.0	(0.5)
Butterfly hanger for LMR-600	BH-12 NH	10	1.0	(0.5)
Butterfly hanger for LMR-900	BH-58 NH	10	1.1	(0.5)
Butterfly hanger for LMR-1200	BH-78 NH	10	1.1	(0.5)
Butterfly hanger for LMR-1700	BH-114 NH	10	1.4	(0.6)

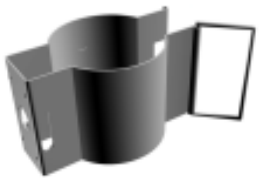
Standard Hangers

Standard hanger for reduced installation time

App.: Coax Support
Size: See chart
Design: Pre-formed bolt-on single run hanger
Feature: Reduced installation time
Mounts to: 7/16" (11.1mm) prepunched hole
Material: Stainless steel
Includes: Hangers and set bolts
Order Sep.: Hanger hardware kits & additional accessories
Note: Hanger hardware kit not included; order separately

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Standard hanger for LMR-400	BH-S38 NH	10	0.8	(0.4)
Standard hanger for LMR-600	BH-S12 NH	10	0.8	(0.4)
Standard hanger for LMR-1200	BH-S78 NH	10	1.8	(0.8)
Standard hanger for LMR-1700	BH-S114 NH	10	1.1	(0.5)

Clip Hangers



Easy install solution

Application: Coax Support
Size: See chart
Design: Clip-on single run hanger
Feature: Easy-to-install solution
Mounts to: 7/16" (11.1mm) prepunched hole
Material: Stainless steel
Includes: Hangers and set bolts
Order Sep.: Hanger hardware kits and additional accessories
Note: Hanger hardware kit not included; order separately

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Clip hanger kit for LMR-600	CH-12 NH	10	0.8	(0.4)
Clip hanger kit for LMR-1200	CH-78 NH	10	0.8	(0.4)
Clip hanger kit for LMR-1700	CH-114 NH	10	1.1	(0.5)

Universal Snap-in Hangers

Snap-in hangers simplify coax installation by eliminating the need for mounting hardware and installation tools.

Application: Coax Support
Size: See chart
Design: One-piece hanger solution
Feature: Simplifies coax installation
Mounts to: 3/4" (19.1mm) holes
Material: Stainless steel
Includes: Hangers
Order Sep.: Additional mounting accessories

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Universal snap-in hanger for LMR-600	SH-U600T	10	0.7	(0.3)
Universal snap-in hanger for LMR-900	SH-U900T	10	1.0	(0.5)
Universal snap-in hanger for LMR-1200	SH-U1200T	10	1.2	(0.5)
Universal snap-in hanger for LMR-1700	SH-U1700T	10	1.3	(0.6)

TIMES MICROWAVE SYSTEMS

Hardware Accessories

Hanger Hardware Kits

Standard, clip and butterfly for flange attachment.

Application: Coax Support
Size: 3/8" or 10mm
Design: Hardware kit for hanger attachment to member
Feature: —
Mounts to: —
Material: Stainless steel
Includes: Bolts, nuts, lockwashers
Order Sep.: Hangers

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Hanger hardware kit, 3/8" x 3/4" slotted hex head bolts, lock washers and hex nuts	HK-34-10	10	0.5	(0.2)
Hanger hardware kit, 3/8" x 1" slotted head bolts lock washers and hex nuts	HK-100-10	10	0.6	(0.3)
Hanger hardware kit, 10mm x 20mm slotted head bolts lock washers and hex nuts	HK-M1020-10	10	0.5	(0.2)

Universal Angle Adapters

Adapt angled members for securing coax hangers.

Application: Coax Support
Size: 3/4" (19.1mm) holes w/ 3/8" tapped insert
Design: Adapts hangers to angle members
Feature: Accepts snap-ins or 3/8" hardware
Mounts to: Up to 7/8" (22mm) angle members
Material: Stainless steel
Includes: Adapters, set bolt, hanger hardwarr kit, avail. w/ or wo insert
Order Sep.: Hangers

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Universal angle adapter for snap-ins or 3/8" tapped holes	AA-U	10	4.9	(2.2)
Angle adapter, large version, with 3/8" threaded hardware	AA-US	10	4.7	(2.1)

Angle Adapters

Adapt angled members for securing coax hangers using 3/8" threaded hardware.

Application: Coax Support
Size: 3/8" tapped holes
Design: Adapts hangers to angle members
Feature: High strength solution
Mounts to: Up to 7/8" (22mm) angle members
Material: Stainless steel
Includes: Adapters, set bolt, hanger hardware kit
Order Sep.: Hangers

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Angle adapter with 3/8" tapped holes	AA-SL	10	5.4	(2.5)
Angle adapter with 10 mm tapped holes	AA-SL-M10	10	5.4	(2.5)

Stand-Off Adapters

Adapt and stand coax off 2" from round members. Unique design easily converts to accommodate snap-in hangers. Round member adapters included unless noted.

Application: Coax Support
Size: 3/8" or 10mm tapped hole
Design: Adapts hangers to round members
Feature: Provides 2" (50.8mm) stand-off
Mounts to: Versions for 1" to 6" (25.4mm to 152.4mm) OD
Material: Stainless steel
Includes: Stand-offs, avail. w. or w.o. hose clamps
Order Sep.: Hangers

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Universal SST stand-off adapter *	SA-38S	10	3.8	(1.7)
Universal SST stand-off adapter for 1"-2" OD members**	SA-38S100	10	3.8	(1.7)
Universal SST stand-off adapter for 2"-3" OD members**	SA-38S200	10	3.8	(1.7)
Universal SST stand-off adapter for 3"-4" OD members**	SA-38S300	10	4.0	(1.8)
Universal SST stand-off adapter for 4"-5" OD members**	SA-38S400	10	4.1	(1.9)
Universal SST stand-off adapter for 5"-6" OD members**	SA-38S500	10	4.4	(2.0)

* Round member adapters not included **Round adapter included

Snap-In Stand-Off Adapters

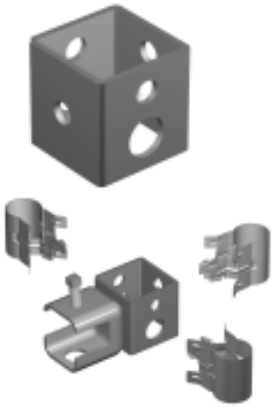
Adapt and stand coax off 2" from round members to avoid obstructions such as tower leg flanges and cross members

Application:	Coax Support
Size:	3/4" (19.1mm) hole
Design:	Adapts hangers to round members
Feature:	Accepts snap-ins
Mounts to:	Versions for 1" to 6" (25.4mm to 152.4mm) OD
Material:	Stainless steel
Includes:	Stand-offs, avail. with or without hose clamps
Order Sep.:	Snap-ins

	TMS part no.	Quant/pkg.	Weight lb (kg)
Snap-In Stand-Off Adapter *	SA-SS	10	2.9 (1.3)
Snap-In Stand-Off Adapter for 1-2" (25.4mm-50.8mm) OD members**	SA-SS100	10	3.8 (1.7)
Snap-In Stand-Off Adapter for 2-3" (50.8mm-76.2mm) OD members**	SA-SS200	10	3.9 (1.8)
Snap-In Stand-Off Adapter for 3-4" (76.2mm-101.6mm) OD members**	SA-SS300	10	4.0 (1.8)
Snap-In Stand-Off Adapter for 4-5" (101.6mm-127.0mm) OD members**	SA-SS400	10	4.1 (1.9)
Snap-In Stand-Off Adapter for 5-6" (127.0mm-152.4mm) OD members**	SA-SS500	10	4.1 (1.9)

* Round member adapters must be purchased separately **Round member adapter included

Mini Cluster Support Bracket



Mini Cluster bracket provides compact mounting support for a variety of different hanger types

Application:	Coax Support
Size:	3/4" (19.1mm) and 7/16" (11.1mm) holes
Design:	Three-run cluster bracket
Feature:	Compact mounting solution
Mounts to:	—
Material:	Hot dip galv. steel
Includes:	Bracket
Order Sep.:	Hangers, mounting hardware

	TMS part no.	Quant/pkg.	Weight lb (kg)
Mini Cluster Support Bracket	CS-BS	10	4.4 (2.0)

Round Member Adapters

Adapt round members when securing most hanger styles.

Application:	Coax Support
Size:	3/4" (19.1mm) and 7/16" (11.1mm) holes
Design:	Three-run cluster bracket
Feature:	Compact mounting solution
Mounts to:	—
Material:	Hot dip galvanized steel
Includes:	Bracket
Order Sep.:	Hangers, mounting hardware

	TMS part no.	Quant/pkg.	Weight lb (kg)
Round member adapter, 1"-2" OD	RMA-100	10	0.8 (0.4)
Round member adapter, 2"-3" OD	RMA-200	10	1.0 (0.5)
Round member adapter, 3"-4" OD	RMA-300	10	1.2 (0.5)
Round member adapter, 4"-5" OD	RMA-400	10	1.3 (0.6)
Round member adapter, 5"-6" OD	RMA-500	10	1.3 (0.6)
Round member adapter, 6"-8" OD	RMA-600	10	1.3 (0.6)

TIMES MICROWAVE SYSTEMS

Hardware Accessories

Lace-up Hoisting Grips

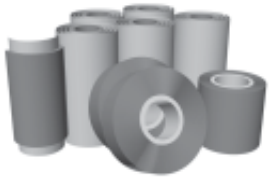
Hoisting Grips provide an effective method for lifting coax cables to the top of a tower where it is tied off to support the cable weight

Application: Coax Support
Size: Versions for coax and elliptical waveguide
Design: Mesh grip with single eye support
Feature: Lace-up installation at any point on coax
Mounts to: —
Material: Tinned bronze
Includes: Grip
Order Sep.: —

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Hoisting Grip for LMR-400 Coaxial Cable*	HG-400T	1	0.3	(1.0)
Lace-up Hoisting Grip for LMR-600 Coaxial Cable	HG-600T	1	0.3	(1.0)
Lace-up Hoisting Grip for LMR-900 Coaxial Cable	HG-900T	1	0.4	(0.2)
Lace-up Hoisting Grip for LMR-1200 Coaxial Cable	HG-1200T	1	0.6	(0.3)
Lace-up Hoisting Grip for LMR-1700 Coaxial Cable	HG-1700T	1	0.6	(0.3)

*LMR-400 Grip is non-lace-up

Universal Weatherproofing Kits



Mastic and electrical tape kit facilitates easy installation and provides a long-term environmental seal for connections.

Application: Coax Protection
Size: —
Design: Tape kit for multi-layer wrap
Feature: Multi-connection protection
Mounts to: —
Material: Butyl and vinyl
WK-U
Includes: Six (6) rolls mastic, 2-1/2" x 24" (64mm x 610mm)
Two (2) rolls electrical tape, 3/4" x 66' (19mm x 20m)
One (1) roll electrical tape, 2" x 20' (51mm x 6m)
Order Sep.: —

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Universal Kit (does 6 connections)	WK-U	1	3.4	(1.5)
Vinyl-mastic Kit (does 2 connections)	WK-2	1	0.6	(0.3)

3M™ Cold Shrink™ Weatherproofing Kits

Avoid tapes and mastics with Cold Shrink™. This unique weatherproofing solution installs in less than three minutes, and eliminates the taping processes. Because no special techniques are required, Cold Shrink™ can be installed perfectly by both new and experienced installers. To apply, position the kit over a connection to form a long term environmental seat. A universally designed spacer accommodates similar coax sizes with tolerance variances allowing these kits to be used on a variety of manufacturers' coaxial cables regardless of your coax preference. Cold Shrink™ kits are available to seal main, feed, jumper and antenna connections.

	TMS part no.	Quant/pkg	Weight lb	(kg)
LMR-400 & LMR-600 (antenna interface)	CS-4060T	1	0.4	(0.2)
LMR-600 (antenna interface)	CS-A-600T	1	0.8	(0.4)
LMR-900 (antenna interface)	CS-A900T	1	0.8	(0.4)
LMR-1200 to LMR-400	CS-40120T	1	0.8	(0.4)
LMR-1200 to LMR-500	CS-50120T	1	0.8	(0.4)
LMR-1200 to LMR-600	CS-60120T	1	0.8	(0.4)
LMR-1200 to LMR-900	CS-90120T	1	0.8	(0.4)
LMR-1700 to LMR-400	CS-40170T	1	1.0	(0.5)
LMR-1700 to LMR-500	CS-50170T	1	1.0	(0.5)
LMR-1700 to LMR-600	CS-60170T	1	0.9	(0.4)
LMR-1700 to LMR-900	CS-90170T	1	0.9	(0.4)

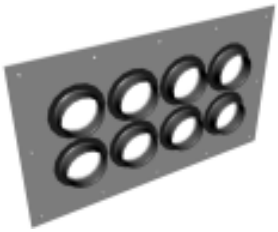
Standard Ground Kits

Pre-formed copper strap facilitates easy installation and protects coax from lightening strikes in excess of 200 kA

Application: Grounding
Size: Versions for coax and elliptical waveguide
Design: Bolt-on style with 5' (1.6m) lead / crimp lug
Feature: RoHS compliant
Mounts to: Coax outer conductor
Material: Tin plated copper strap
Includes: Ground kit, lug, weatherproofing kit
Order Sep.: —

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Standard Ground Kit for LMR-195 Coaxial Cable	GK-S195TT	1	1.4	(0.6)
Standard Ground Kit for LMR-200 Coaxial Cable	GK-S200TT	1	1.4	(0.6)
Standard Ground Kit for LMR-240 Coaxial Cable	GK-S240TT	1	1.4	(0.6)
Standard Ground Kit for LMR-300 Coaxial Cable	GK-S300TT	1	1.4	(0.6)
Standard Ground Kit for LMR-400 Coaxial Cable	GK-S400TT	1	1.4	(0.6)
Standard Ground Kit for LMR-500 Coaxial Cable	GK-S500TT	1	1.4	(0.6)
Standard Ground Kit for LMR-600 Coaxial Cable	GK-S600TT	1	1.4	(0.6)
Standard Ground Kit for LMR-900 Coaxial Cable	GK-S900TT	1	1.4	(0.6)
Standard Ground Kit for LMR-1200 Coaxial Cable	GK-S1200TT	1	1.4	(0.6)
Standard Ground Kit for LMR-1700 Coaxial Cable	GK-S1700TT	1	1.4	(0.6)

4" Feed-thru Entry Panels



Traditional panel for weather-tight building penetration

Application: Entry Port Solutions
Size: 20 configurations
Design: Entry plates with round ports
Feature: Easy to install solution
Mounts to: Walls
Material: Aluminum
Includes: Port, caps, mounting hardware
Order Sep.: 4" (101.6mm) Boot Assemblies

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Entry Panel, 1 port, 1 x 1, standard	EP-220	1	1.0	(0.5)
Entry Panel, 1 port, 1 x 1, compact	EP-574	1	0.6	(0.3)
Entry Panel, 2 port, 1 x 2	EP-1448	1	2.3	(1.0)
Entry Panel, 3 port, 1 x 3	EP-1635	1	2.9	(1.3)
Entry Panel, 4 port, 1 x 4	EP-575	1	3.5	(1.6)
Entry Panel, 4 port, 2 x 2, standard	EP-1199	1	4.2	(1.9)
Entry Panel, 4 port, 2 x 2, compact	EP-1650	1	4.0	(1.8)
Entry Panel, 6 port, 2 x 3	EP-1449	1	6.1	(2.8)
Entry Panel, 6 port, 1 x 6	EP-1477	1	6.0	(2.7)
Entry Panel, 8 port, 2 x 4, standard	EP-576	1	6.1	(2.8)
Entry Panel, 8 port, 2 x 4, large	EP-1338	1	6.0	(2.7)
Entry Panel, 9 port, 3 x 3	EP-1033	1	7.1	(3.2)
Entry Panel, 10 port, 2 x 5	EP-1297	1	7.4	(3.4)
Entry Panel, 12 port, 3 x 4, standard	EP-1118	1	8.5	(3.9)
Entry Panel, 12 port, 3 x 4, large	EP-1334	1	7.0	(3.2)
Entry Panel, 12 port, 2 x 6	EP-1336	1	9.2	(4.2)
Entry Panel, 16 port, 4 x 4	EP-1447	1	9.1	(4.1)
Entry Panel, 18 port, 3 x 6	EP-1333	1	13.0	(5.9)
Entry Panel, 20 port, 4 x 5	EP-1861	1	11.0	(5.0)
Entry Panel, 24 port, 4 x 6	EP-1340	1	15.8	(7.2)

Note: Custom configurations available. Contact your sales administrator for details

TIMES MICROWAVE SYSTEMS

Hardware Accessories

Feed-Thru Boot Assemblies

Innovative one-piece design simplifies installation. For use with EP-series feed-thru entry panels. Order cushion insert separately.

Application:	Entry Port Solutions
Size:	4" (101.6mm) and 5" (127.0mm)
Design:	Compression boot for aluminum entry panels
Feature:	One-piece design simplifies installation
Mounts to:	Entry panels
Material:	EPDM rubber
Includes:	Boot, two hose clamps
Order Sep.:	Cushion Inserts, Entry Panel

	TMS part no.	Quant/pkg.	Weight lb	(kg)
4" Boot assembly, cushion not included	BA-400	1	1.3	(0.6)

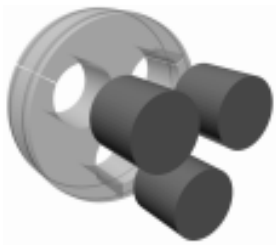
Cushion Inserts

Standard port cushions are used with BA-400 boot assembly.

Application:	Entry Port Solutions
Size:	Versions for coax and elliptical waveguide
Design:	Compression fit round cushions
Feature:	Dependable seal
Mounts to:	Feed-Thru Boot Assembly
Material:	EPDM rubber
Includes:	Cushion
Order Sep.:	Boot Assembly, Entry Panel

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Standard port cushion, blank (no holes)	SC-B	1	0.4	(0.2)
Standard port cushion with 6 holes for LMR-400 coax	SC-400T-6	1	0.4	(0.2)
Standard port cushion with 1 hole for LMR-600 coax	SC-600T-1	1	0.4	(0.2)
Standard port cushion with 2 holes for LMR-600 coax	SC-600T-2	1	0.4	(0.2)
Standard port cushion with 3 holes for LMR-600 coax	SC-600T-3	1	0.4	(0.2)
Standard port cushion with 4 holes for LMR-600 coax	SC-600T-4	1	0.4	(0.2)
Standard port cushion with 1 hole for LMR-900 coax	SC-900-1	1	0.4	(0.2)
Standard port cushion with 2 holes for LMR-900 coax	SC-900-2	1	0.4	(0.2)
Standard port cushion with 3 holes for LMR-900 coax	SC-900-3	1	0.4	(0.2)
Standard port cushion with 4 holes for LMR-900 coax	SC-900-4	1	0.4	(0.2)
Standard port cushion with 1 hole for LMR-1200 coax	SC-1200T-1	1	0.4	(0.2)
Standard port cushion with 2 holes for LMR-1200 coax	SC-1200T-2	1	0.4	(0.2)
Standard port cushion with 3 holes for LMR-1200 coax	SC-1200T-3	1	0.3	(0.1)
Standard port cushion with 1 hole for LMR-1700 coax	SC-1700T-1	1	0.3	(0.1)

Cushion Plugs



Cushion plugs are used to fill unoccupied holes.

Application:	Entry Port Solutions
Size:	1/2" to 1-5/8" coax
Design:	Plugs for unused cushion holes
Feature:	Allows for future expansion
Mounts to:	Cushion Inserts
Material:	EPDM rubber
Includes:	Plugs
Order Sep.:	Cushion Inserts or Boot Assemblies

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Cushion plug for LMR-600 coax	CP-600T	5	0.2	(0.1)
Cushion plug for LMR-900 coax	CP-900T	5	0.3	(0.1)
Cushion plug for LMR-1200 coax	CP-1200T	5	0.3	(0.1)
Cushion plug for LMR-1700 coax	CP-1700T	5	0.5	(0.2)

Engineered Products

FBT® Flexible Low Loss High Power Cable

FBT® is a flexible low loss indoor/outdoor highly fire retardant cable suitable for use up to 150°C. Intended specifically for runs within and between base station cabinets, it can also be used in return air handling plenums or outdoors.

FlexTech™ Commercial Cable Assemblies

The use of higher frequencies for telecommunications applications has placed increasingly rigorous demands on cable assembly performance. Our 50 year plus background in military microwave assemblies has provided us the expertise to address these performance requirements, while our commercial expertise allows us to provide economical solutions. FlexTech™ jumper assemblies furnished standard with LMR-DB cable provide rugged dependability for any application.

T-RAD™ 50 Ohm Leaky Feeder Cable

T-RAD™ leaky feeder cables offer a cost effective solution to providing RF coverage in enclosed areas. The flexibility of the cable combined with quick attachment connectors, allows the cable to be easily installed, which is ideal for in-building applications.

SilverLine™

SilverLine™ Test Cables are cost effective, durable, high-performance cable assemblies designed for use in a broad range of test and interconnect applications. Fabricated from rugged, solid PTFE dielectric cable with stainless steel connectors and a proven strain relief system, these cables provide long life and excellent stability in applications where they are repeatedly flexed and mated/unmated. SilverLine™ test cables are ideal for use in production, field and laboratory test environments. They are also economical enough to be used as interconnects in test systems.

LMR Bundled Cable

By pre-assembling LMR® cables together under a common polyethylene outer jacket, this innovative design is the perfect solution for Smart Antenna and other sector applications. LMR® Bundled Cable greatly reduces the cost of installation by slashing the cost of labor and accessories compared to an installation using individual runs. LMR® Bundled Cable is supplied as a complete system, including weather seal breakout boots and ground kits with full technical support and custom tools, pictorial instructions and installation videos.

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-195
Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-195 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-195. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-195 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-195 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-195 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Low Density PTFE	0.113	(2.87)
Outer Conductor	Aluminum Tape	0.119	(3.02)
Overall Braid	Tinned Copper	0.142	(3.61)
Jacket	Brown FEP	0.175	(4.45)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.020	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.19)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

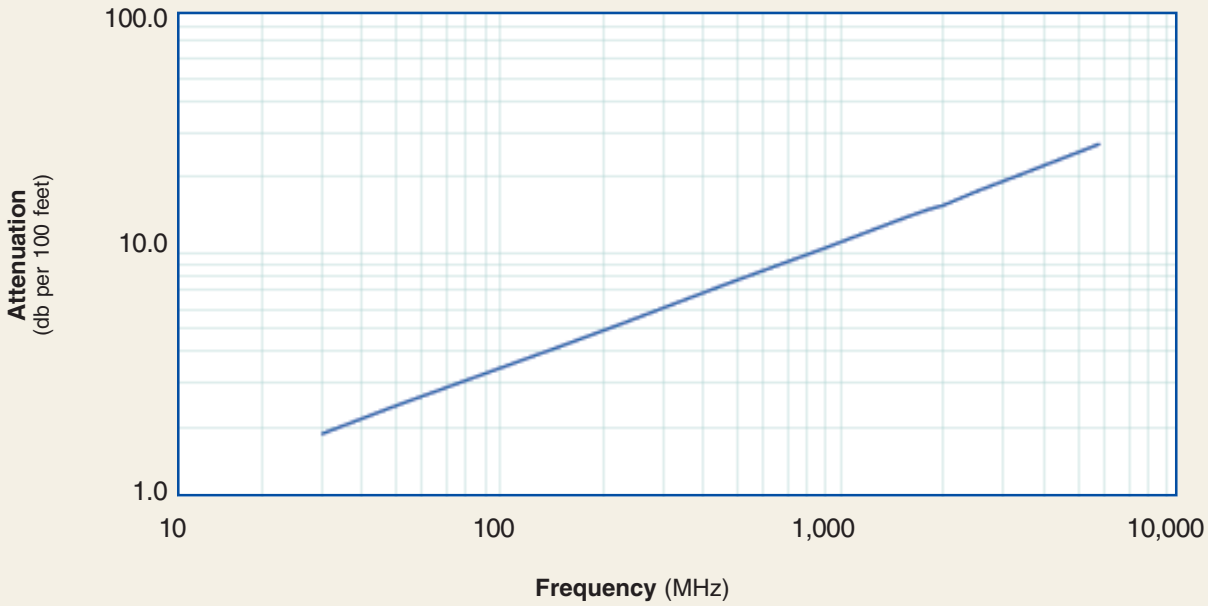
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.7	(25.3)
Outer Conductor	ohms/1000ft (/km)	4.90	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description

Part No.	Application	Jacket	Color	Stock Code
FBT-195	Indoor/Outdoor	FEP	Brown	54165

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	2.0	2.5	4.4	5.3	7.8	10.9	14.1	15.4	16.3	18.3	21.4	28.2
Attenuation dB/100 m	6.4	8.3	14.4	17.5	25.1	35.6	46.2	50.7	53.5	60.0	70.2	92.5
Avg. Power kW	1.62	1.25	0.72	0.59	0.41	0.29	0.22	0.20	0.19	0.17	0.14	0.11

Calculate Attenuation = (0.340820) • $\sqrt{\text{FMHz}}$ + (0.000183) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
Sea Level; dry air; atmospheric pressure; no solar loading


TC-195-NM


TC-195-SM


TC-195-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073(33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045(20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


CT-240/200/195/100

Install Tools


CCT-01

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100,195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-200
Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-200. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-200 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-200 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BC	0.040	(1.02)
Dielectric	Low Density PTFE	0.118	(3.00)
Outer Conductor	Aluminum Tape	0.123	(3.12)
Overall Braid	Tinned Copper	0.146	(3.71)
Jacket	Brown FEP	0.175	(4.45)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.032	(0.05)
Tensile Strength	lb (kg)	30	(13.6)
Flat Plate Crush	lb/in. (kg/mm)	65	(1.169)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

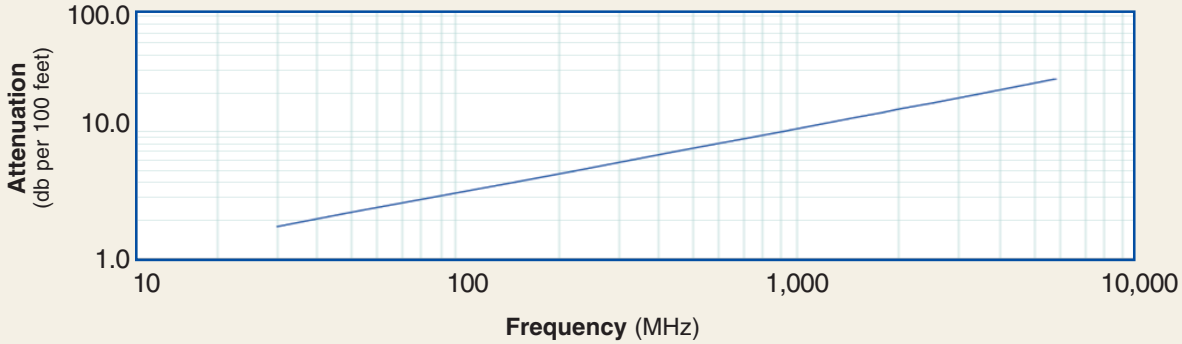
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	6.50	(21.3)
Outer Conductor	ohms/1000ft (/km)	4.90	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description

Part No.	Application	Jacket	Color	Stock Code
FBT-200	Indoor/Outdoor	FEP	Brown	54166

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.8	2.3	4.1	4.9	7.1	10.0	13.0	14.3	15.1	16.9	19.8	26.1
Attenuation dB/100 m	5.9	7.7	13.3	16.1	23.2	32.9	42.7	46.9	49.5	55.5	65.0	85.7
Avg. Power kW	1.71	1.32	0.76	0.62	0.43	0.30	0.23	0.21	0.20	0.18	0.15	0.11

Calculate Attenuation = (0.329075) • $\sqrt{\text{FMHz}}$ + (0.000183) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-200-BM


TC-200-MUHF


TC-200-NM


TC-200-NM-RP


TC-200-SM


TC-200-SM-RP


TC-200-TMC


TC-200-TF

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
BNC Male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7	(43.2)	0.56	(14.2)	0.045	(20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1	(27.9)	0.45	(11.4)	0.015	(6.8)
N Male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5	(38.1)	0.75	(19.1)	0.073	(33.1)
	Reverse Polarity	TC-200-NM-RP	3190-959	<1:25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5	(38.0)	0.75	(19.1)	0.073	(33.1)
SMA Male	Straight plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.015	(6.8)
SMA Male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25.4)	0.32	(8.1)	0.015	(6.8)
TNC Male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43.2)	0.59	(15.0)	0.045	(20.4)
TNC Female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.3	(33.0)	0.57	(14.5)	0.033	(15.0)

*Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200TT	GK-S200TT	Standard Ground Kit (each)


GK-S200TT

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blade for cutting tool


CT-240/200/195/100


CCT-01

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-240
Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-240 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-240. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-240 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-240 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-240 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
FBT-240	Indoor/Outdoor	FEP	Brown	54167

Construction Specifications			
Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BC	0.051	(1.30)
Dielectric	Low Density PTFE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	Brown FEP	0.205	(5.21)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.040	(0.06)
Tensile Strength	lb (kg)	60	(27.2)
Flat Plate Crush	lb/in. (kg/mm)	85	(1.52)

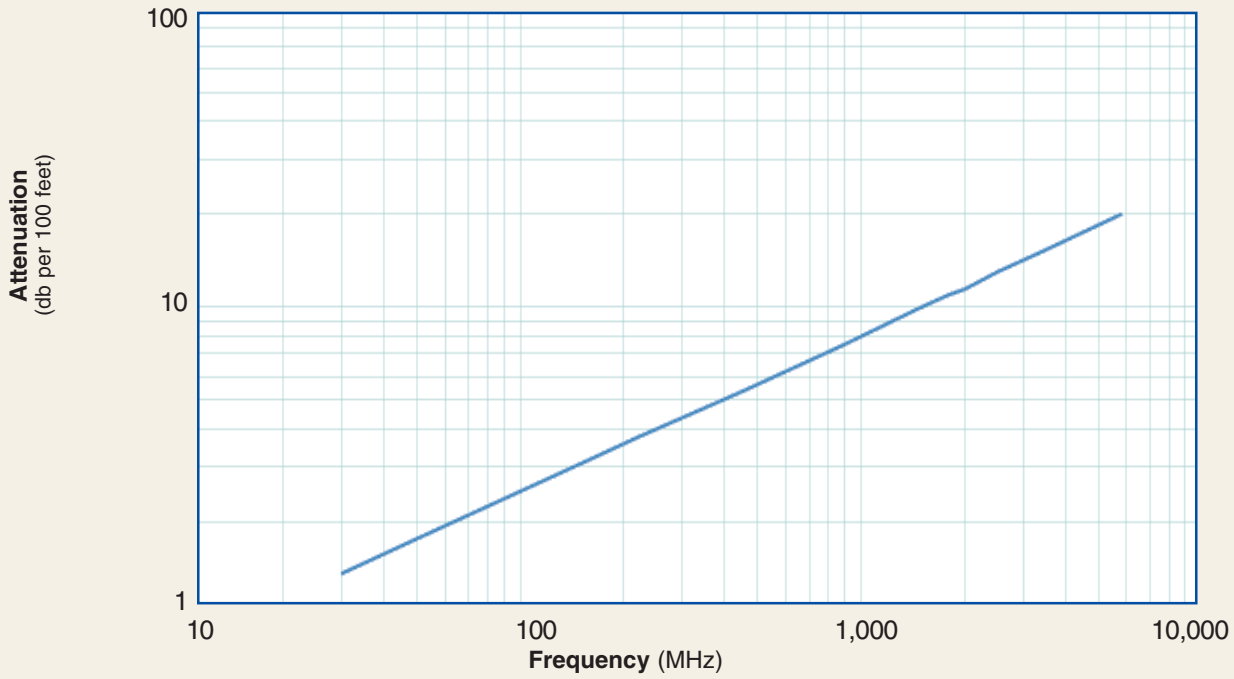
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	28	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	4.00	(13.1)
Outer Conductor	ohms/1000ft (/km)	3.90	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.4	1.8	3.1	3.7	5.4	7.6	9.9	10.9	11.5	12.9	15.1	20.0
Attenuation dB/100 m	4.5	5.8	10.1	12.2	17.6	25.0	332.5	35.7	37.7	42.3	49.6	65.6
Avg. Power kW	2.48	1.92	1.10	0.91	0.63	0.44	0.34	0.31	0.29	0.26	0.22	0.17

Calculate Attenuation =
$(0.248515) \bullet \sqrt{FMHz} + (0.000183) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT-240
Flexible Low Loss High Power Communications Coax


TC-240-NMH


TC-240-NMC


TC-240-BMC


TC-240-TM


TC-240-TM-RA


TC-240-SM


TC-240-SM-RA


TC-240-SF-BH


TC-240-SM-RP


TC-240-NF-BH


TC-240-MUHF

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7	(43)	0.56	(14.2)	0.040	(18.1)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.1	(28)	0.45	(11.4)	0.014	(6.4)
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25 (2.5)	NA	Solder	Crimp	A/G	1.7	(44)	0.88	(22.2)	0.115	(52.2)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	N/S	1.5	(38)	0.75	(19.1)	0.086	(39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5	(38)	0.75	(19.1)	0.082	(37.2)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1	(29)	0.31	(7.9)	0.019	(8.6)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8	(20)	0.65	(16.5)	0.019	(8.6)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.32	(8.1)	0.016	(7.3)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.043	(19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/G	1.3	(33)	0.57	(14.5)	0.055	(24.9)

*Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S240TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240TT	GK-S240TT	Standard Ground Kit (each)


CCT-01

Install Tools


CT-240/200/195/100

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100, 195, 200 and 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-300
Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-300 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-300. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-300 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-300 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-300 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BC	0.063	(1.60)
Dielectric	Low Density PTFE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Brown FEP	0.260	(6.60)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.3	(31.8)
Bend Radius: repeated	in. (mm)	3	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.065	(0.10)
Tensile Strength	lb (kg)	120	(54.52)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

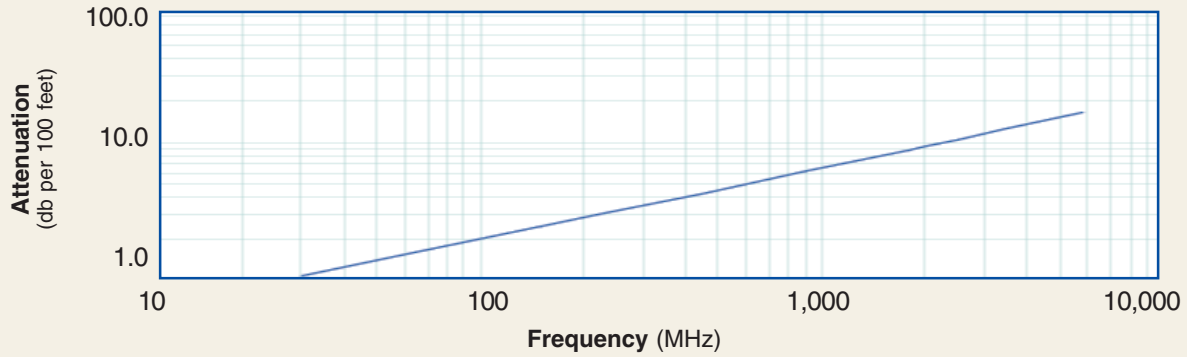
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	23	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.61	(8.6)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Part Description

Part No.	Application	Jacket	Color	Stock Code
FBT-300	Indoor/Outdoor	FEP	Brown	54168

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.1	1.4	2.5	3.0	4.3	6.2	8.0	8.8	9.3	10.5	12.3	16.3
Attenuation dB/100 m	3.6	4.7	8.1	9.9	14.2	20.2	26.3	28.9	30.6	34.3	40.3	53.5
Avg. Power kW	3.44	2.67	1.53	1.26	0.87	0.61	0.47	0.43	0.40	0.36	0.30	0.23

Calculate Attenuation = (0.200179) • $\sqrt{\text{FMHz}}$ + (0.000183) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading


TC-300-NM


TC-300-NM-RA


TC-300-TM


TC-300-SM


TC-300-SF-BH

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	N/S	1.6	(41)	0.85	(21.6)	0.074	(33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (2.5)	Knurl	Solder	Crimp	N/S	1.5	(38)	0.85	(21.6)	0.101	(45.8)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0	(25)	0.35	(8.9)	0.018	(8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1	(28)	0.31	(7.9)	0.022	(10.0)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/S	1.7	(43)	0.59	(15.0)	0.050	(22.7)

*Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300TT	GK-S300TT	Standard Ground Kit (each)


GK-S300TT


CT-300/400

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR 300 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool


CCT-01

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-400
Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-400 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-400. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-400 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-400 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-400 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
FBT-400	Indoor/Outdoor	FEP	Brown	54171

Construction Specifications

Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.095	(2.41)
Dielectric	Low Density PTFE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Brown FEP	0.370	(9.40)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.8	(44.5)
Bend Radius: repeated	in. (mm)	4	(101.6)
Bending Moment	ft-lb (N-m)	1	(1.36)
Weight	lb/ft (kg/m)	0.104	(0.15)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	185	(3.31)

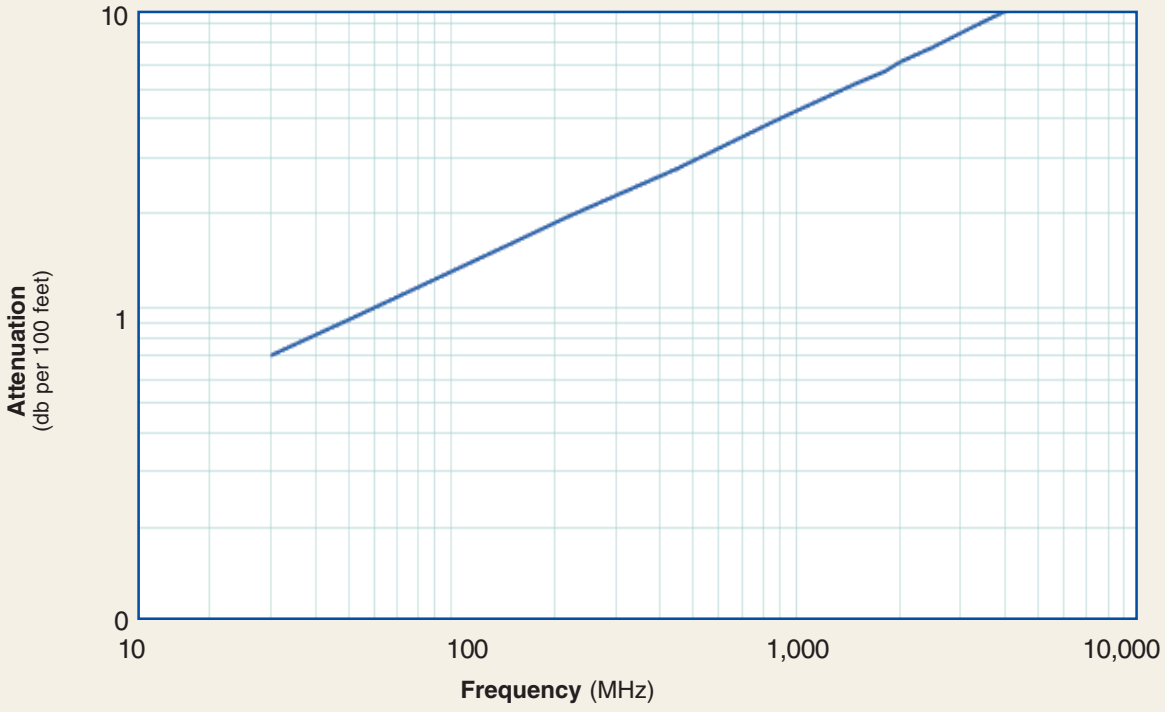
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	15	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.80	(5.9)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.7	0.9	1.6	1.9	2.8	4.0	5.2	5.7	6.1	6.8	8.0	10.7
Attenuation dB/100 m	2.3	3.0	5.3	6.4	9.2	13.1	17.1	18.8	19.9	22.4	26.3	35.0
Avg. Power kW	6.23	4.82	2.76	2.27	1.58	1.10	0.84	0.77	0.73	0.65	0.55	0.41

Calculate Attenuation =
$(0.129138) \bullet \sqrt{FMHz} + (0.000146) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT-400
Flexible Low Loss High Power Communications Coax


EZ-400-NMH-PL-D


TC-400-NMH-PL


TC-400-NMH-RA

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-400-NMH-PL-D	3190-602	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Clamp	S/G	1.5 (38)	0.89 (22.6)	0.113(51.3)
	Straight Plug	TC-400-NMH-PL	3190-759	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113(51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130(59.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S400T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)


HX-4


DBT-01


Y1719


CCT-01


CT-400/300


TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Deburr Tool	DBT-01	3190-406	For 'EZ' Style Connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-500
Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-500 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-500. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-500 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-500 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-500 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.123	(3.12)
Dielectric	Low Density PTFE	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	Brown FEP	0.465	(11.81)

Mechanical Specifications

Performance Property	Units	US	metric
Bend Radius: installation	in. (mm)	2.3	(57.2)
Bend Radius: repeated	in. (mm)	5	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.104	(0.15)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	185	(3.31)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

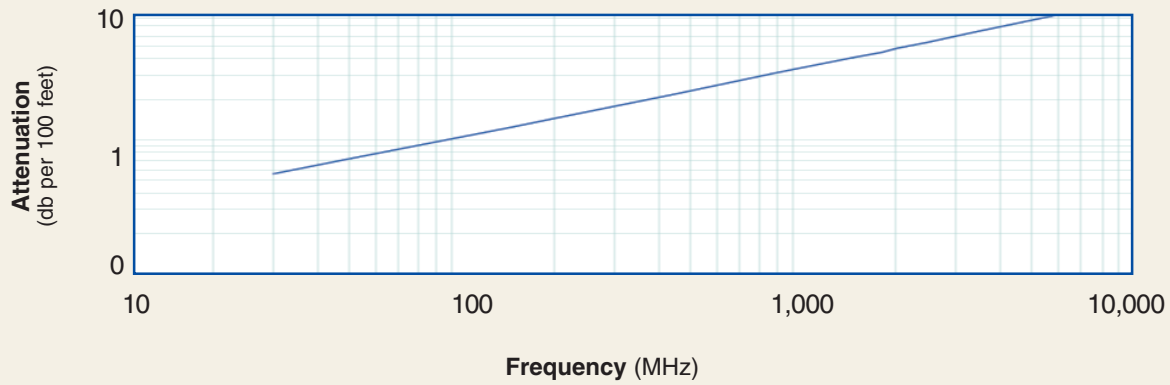
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	11.6	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.09	(3.6)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	11.6	

Part Description

Part No.	Application	Jacket	Color	Stock Code
FBT-500	Indoor/Outdoor	FEP	Brown	54172

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.6	0.7	1.3	1.5	2.2	3.1	4.1	4.5	4.8	5.4	6.4	8.5
Attenuation dB/100 m	1.8	2.3	4.1	5.0	7.2	10.3	13.5	14.8	15.7	17.6	20.9	27.9
Avg. Power kW	8.90	6.88	3.94	3.24	2.24	1.56	1.20	1.08	1.03	0.91	0.77	0.57

Calculate Attenuation = (0.100255) • $\sqrt{\text{FMHz}}$ + (0.000146) • FMHz (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) **Power:** VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TC-500-NMC-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-500-NMC-PL	3190-900	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

HX-4

Y151

DBT-01

Install Tools

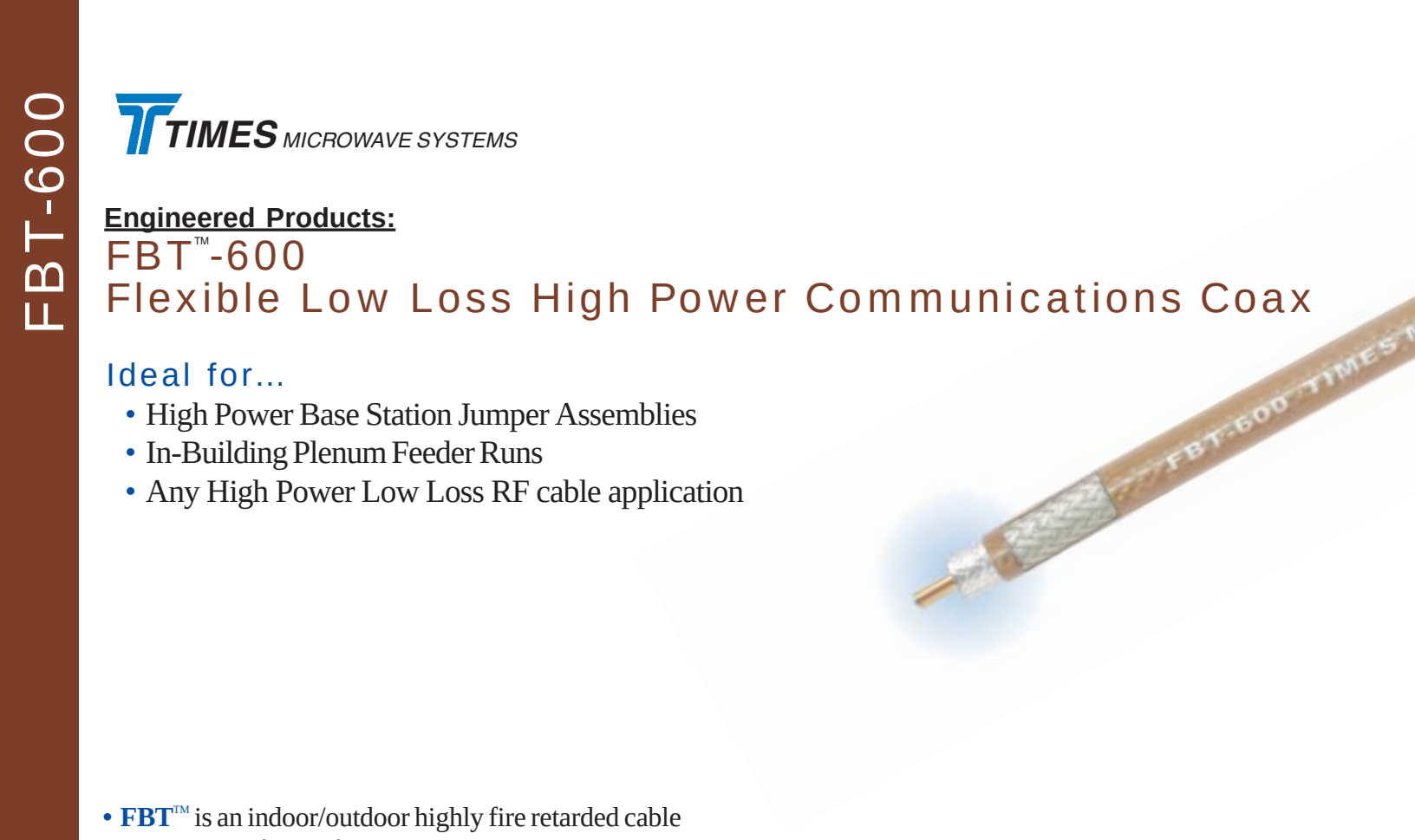
Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

CCT-01

TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT™-600
Flexible Low Loss High Power Communications Coax



Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application

• **FBT**™ is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-600. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-600 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
FBT-600	Indoor/Outdoor	FEP	Brown	54173

Construction Specifications

Descrirtion	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.150	(3.81)
Dielectric	Low Density PTFE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Brown FEP	0.565	(14.38)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	2.8	(69.9)
Bend Radius: repeated	in. (mm)	6	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.210	(0.31)
Tensile Strength	lb (kg)	265	(120.3)
Flat Plate Crush	lb/in. (kg/mm)	210	(3.75)

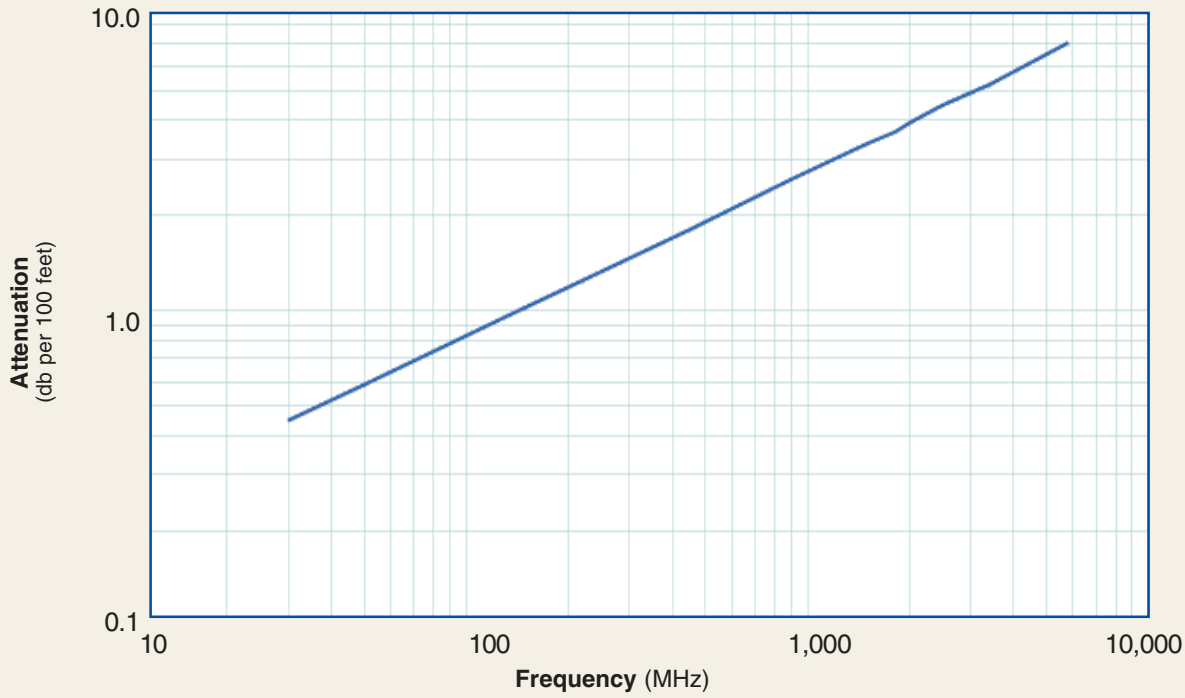
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	9.4	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.73	(2.4)
Outer Conductor	ohms/1000ft (/km)	1.20	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency **(typical)**



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.5	0.6	1.0	1.2	1.8	2.6	3.4	3.7	3.9	4.4	5.3	7.1
Attenuation dB/100 m	1.5	1.9	3.3	4.1	5.9	8.4	11.1	12.2	12.9	14.5	17.2	23.2
Avg. Power kW	11.84	9.14	5.23	4.30	2.97	2.07	1.57	1.43	1.35	1.20	1.01	0.75

Calculate Attenuation =
$(0.081389) \bullet \sqrt{FMHz} + (0.000146) \bullet FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

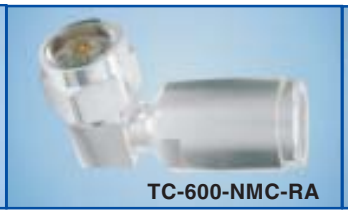
TIMES MICROWAVE SYSTEMS

Engineered Products:

FBT-600
Flexible Low Loss High Power Communications Coax


EZ-600-NMH-PL-D


TC-600-NMH-PL


TC-600-NMC-RA


TC-600-NMH-RA

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-PL-D	3190-603	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166(75.3)
	Straight Plug	TC-600-NMH-PL	3190-760	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.208(93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.280(17.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.185(83.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair


GK-S600TT

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)


HX-4


DBT-01


CR-600


Y1720


GST-600A


TK-600EZ


CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool

TIMES MICROWAVE SYSTEMS

Engineered Products:

FlexTech™ Commercial Cable Assemblies

Performance:

The use of higher frequencies for telecommunications applications has placed increasingly rigerous demands on cable assembly performance. Our 50 year plus background in military microwave assemblies has provided us the expertise to address these performance requirements, while our commercial expertise allows us to provide economical solutions.

Testing:

- VSWR or Return Loss
- Insertion Loss
- Time Delay
- Absolute or Relative Phase Matching
- Phase Trimming

Value Added

- Variety of Strain Relief Boots
- Multitude of Labeling Possibilities
- Bar Coding
- Customized Packaging

Connector Specifications: *FlexTech™* cable assemblies can be furnished with virtually any connector interface.

Cable Specifications: *FlexTech™* jumper assemblies are furnished standard with LMR-DB cable unless otherwise requested. Cable performance characteristics are listed in the section for each individual cable size. The following table summarizes the characteristics of general interest.

Cable Type	LMR-400	LMR-600	LMR-900
Diameter	.405"	.590"	.870"
Impedance		50 Ohms	
Bend Radius	1"	1-1/2"	3"
Weight(lbs/ft)	.068	.131	.266
Temperature		-40°C to +85°C	

Assembly Part Numbers Definition

Cable Type — Cable Length

LMR-400-DB/3ft/Nm/Nm

Connector 1 — Connector 2

Cable Type	Length	Connectors 1&2
LMR-xxx LMR-xxx-FR LMR-xxx-LLPL LMR-xxx-UF LMR-xxx-W LMR-xxx-DB	ft in m cm	See available connectors for the particular cable

TIMES MICROWAVE SYSTEMS

Specialized WLAN Assemblies

Competitively Priced

The cable assembly list below has been developed to provide a quick cross reference to a Times Microwave Systems part number for some of the more common configurations being used for WLAN applications. Any of these assemblies ordered by the TMS part number in the right hand column will be 100% tested for IL and VSWR in the relevant brand.

Equipment OEM	OEM part # or model	Cable	Length	Connector 1	Connector 2	TMS part #
Agere		LMR-400-DB	50'	Nm	Nm	AE14563
Agere		LMR-400-DB	75'	Nm	Nm	AE14564
Alvarion/Breezecom		LMR-195-DB	3'	Nt	Sm RA cust.	AE14564
Alvarion/Breezecom		LMR-195-DB	20'	Nt	SM RA cust.	AE14566
Alvarion/Breezecom		LMR-195-DB	50'	Nt	Sm. RA cust.	AE14567
Alvarion/Breezecom		LMR-195-DB	75'	Nt	Sm. RA cust.	AE14568
Alvarion/Breezecom		LMR-195-DB	100'	Nt	Sm. RA cust.	AE14569
Alvarion/Breezecom		LMR-195-DB	3'	Nm	Sm. RA cust.	AE14570
Alvarion/Breezecom		LMR-195-DB	20'	Nm	Sm. RA cust.	AE14571
Alvarion/Breezecom		LMR-195-DB	50'	Nm	Sm. RA cust.	AE14572
Alvarion/Breezecom		LMR-195-DB	75'	Nm	Sm. RA cust.	AE14573
Alvarion/Breezecom		LMR-195-DB	100'	Nm	Sm. RA cust.	AE14574
Cisco/Aironet		LMR-200-DB	5'	TNCm RP	TNCf RP	AE14575
Cisco/Aironet		LMR-200-DB	10'	TNCm RP	TNCf RP	AE14576
Cisco/Aironet	72-2760-02	LMR-400-DB	20'	TNCm RP	TNCf RP	AE14577
Cisco/Aironet	72-2760-02	LMR-400-DB	50'	TNCm RP	TNCf RP	AE14578
Cisco/Aironet		LMR-600-DB	20'	TNCm RP	TNCf RP	AE14579
Cisco/Aironet		LMR-600-DB	50'	TNCm RP	TNCf RP	AE14580
Cisco/Aironet	72-2766-02	LMR-600-DB	100'	TNCm RP	TNCf RP	AE14581
Cisco/Aironet	72-2787-02	LMR-600-DB	150'	TNCm RP	TNCf RP	AE14582
Enterasy/Cabletron	CSIES-AB-C20	LMR-200-DB	20'	Nm	Nm	AE14583
Enterasy/Cabletron	CSIES-AA-C20	LMR-200-DB	20'	Nm RP	Nm RP	AE14584
Enterasy/Cabletron	CSIES-AB-C50	LMR-400-DB	50'	Nm	Nm	AE14563
Enterasy/Cabletron	CSIES-AA-C50	LMR-400-DB	50'	Nm RP	Nm RP	AE14585
Enterasy/Cabletron	CSIES-AB-C50	LMR-400-DB	75'	Nm	Nm	AE14564
Enterasy/Cabletron	CSIES-AA-C50	LMR-400-DB	75'	Nm RP	Nm RP	AE14586
Orinoco		LMR-100	2'	WaveLANm RA	Nt	AE14587
Orinoco		LMR-100	2'	WaveLANm RA	Nm	AE14588
Proxim		LMR-195-DB	3'	Sm RP	Nf	AE14589
Proxim		LMR-195-DB	3'	Sm RP	Nm	AE14590
Proxim		LMR-100	2'	mmcx RA m	Nf	AE14592
Symbol		LMR-195-DB	3'	BNCm RP	Nf	AE14592
Symbol		LMR-195-DB	3'	BNCm RP	Nm	AE14593

TIMES MICROWAVE SYSTEMS

Engineered Products:

T-RAD-600
50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- Accepts standard "EZ" crimp connectors used for LMR-600 cable*

Part Description				Stock
Part No.	Application	Jacket	Color	Code
AA 9096	T-RAD-600-PVC	PVC	Black	44030
AA-9097	T-RAD-600-FR	FRPE	Black	44031

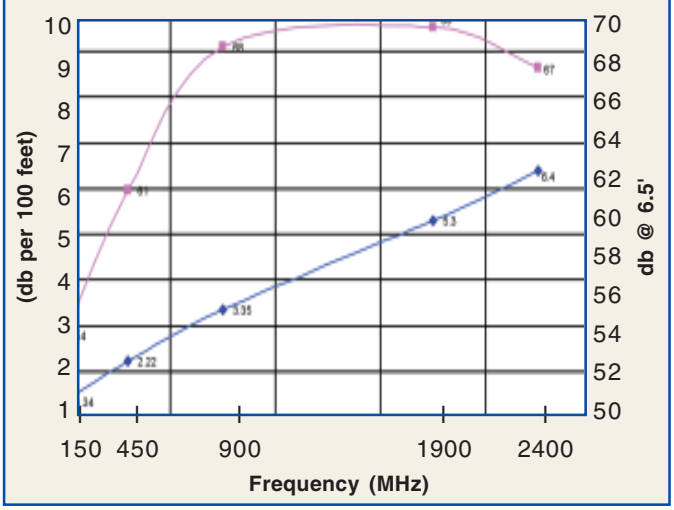
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.176	(4.47)
Dielectric	Gas-Injected Foam Polyethylene	0.455	(11.56)
Inner Shield	Bonded Aluminum Tape	0.458	(11.63)
Jacket	See table above	0.530	(13.46)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Weight	lb/ft (kg/m)	0.09	(0.137)

Environmental Specifications		
Performance Property	°F	°C
Operating Temperature Range	-40/+185	-40/+85

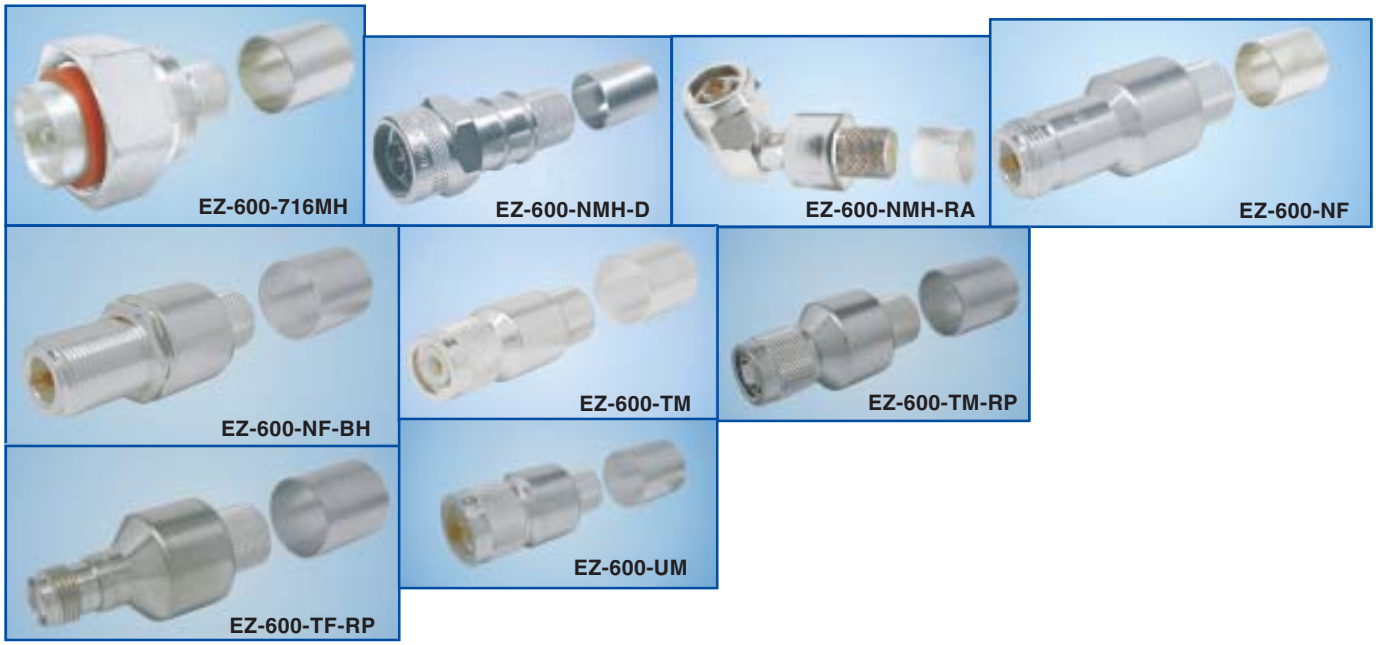
Electrical Specifications			
Performance Property	Units	US	(metric)
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.87)
Impedance	ohms	50	
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	6000	

Loss & Coupling vs. Frequency **(typical)**



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.34	2.22	3.35	5.30	6.40
Attenuation dB/100 m	4.39	7.28	10.98	17.38	20.99
Coupling Loss** dB	54	61	68	69	67

* Request T-RAD-600 connector data sheet and attachment instructions
** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
7-16DINMale	StraightPlug	EZ-600-716-MH	3190-503	<1.25:1 (2.5)	Hex	SpringFinger	Crimp	S/S	2.0 (51)	1.30 (33.0)	0.254 (115.2)
NMale	StraightPlug	EZ-600-NMH-D	3190-1268	<1.25:1 (2.5)	Hex/Knurl	SpringFinger	Crimp	A/G	2.1 (53)	0.92 (23.4)	1.164 (74.4)
	RightAngle	EZ-600-NMH-RA	3190-762	<1.35:1 (6)	Hex	SpringFinger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.185 (83.9)
NFemale	StraightJack	EZ-600-NF	3190-955	<1.25:1 (2.5)	NA	SpringFinger	Crimp	S/G	2.3 (59)	0.87 (22.1)	0.150 (68.0)
	BulkheadJack	EZ-600-NF-BH	3190-616	<1.25:1 (2.5)	NA	SpringFinger	Crimp	S/G	2.4 (61)	0.88 (22.4)	0.195 (88.5)
TNCMale	StraightPlug	EZ-600-TM	3190-418	<1.25:1 (2.5)	Knurl	SpringFinger	Crimp	S/G	1.7 (43)	0.59 (15.0)	0.112 (50.8)
	ReversePolarity	EZ-600-TM-RP	3190-796	<1.25:1 (2.5)	Knurl	SpringFinger	Crimp	A/G	2.2 (56)	0.87 (22.0)	0.112 (50.8)
TNCFemale	ReversePolarity	EZ-600-TF-RP	3190-797	<1.25:1 (2.5)	NA	SpringFinger	Crimp	A/G	2.3 (58)	0.87 (22.0)	0.100 (45.4)
UHFMale	StraightPlug	EZ-600-UM	3190-615	<1.25:1 (2.5)	Knurl	SpringFinger	Crimp	S/G	1.7 (43)	0.88 (22.4)	0.164 (74.4)

*Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

TIMES MICROWAVE SYSTEMS

Engineered Products:

T-RAD-600-DB
50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Watertight design for direct bury applications
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- Accepts standard "EZ" crimp connectors used for LMR-600 cable*

Part Description				Stock
Part No.	Application	Jacket	Color	Code
AA-9299	T-RAD-600-DB	PVC/PE	Black	44038

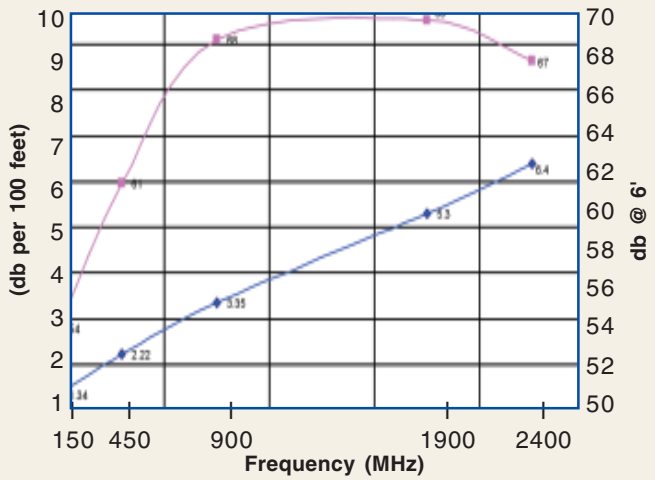
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.176	(4.47)
Dielectric	Gas-Injected Foam Polyethylene	0.455	(11.56)
Inner Shield	Bonded Aluminum Tape	0.458	(11.63)
Jacket	Extruded PVC/PE	0.590	(14.98)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38)
Bend Radius: repeated	in. (mm)	0.12	(.178)
Weight	lb/ft (kg/m)	0.09	(0.137)

Environmental Specifications		
Performance Property	°F	°C
Operating Temperature Range	+23/+167	-5/+75

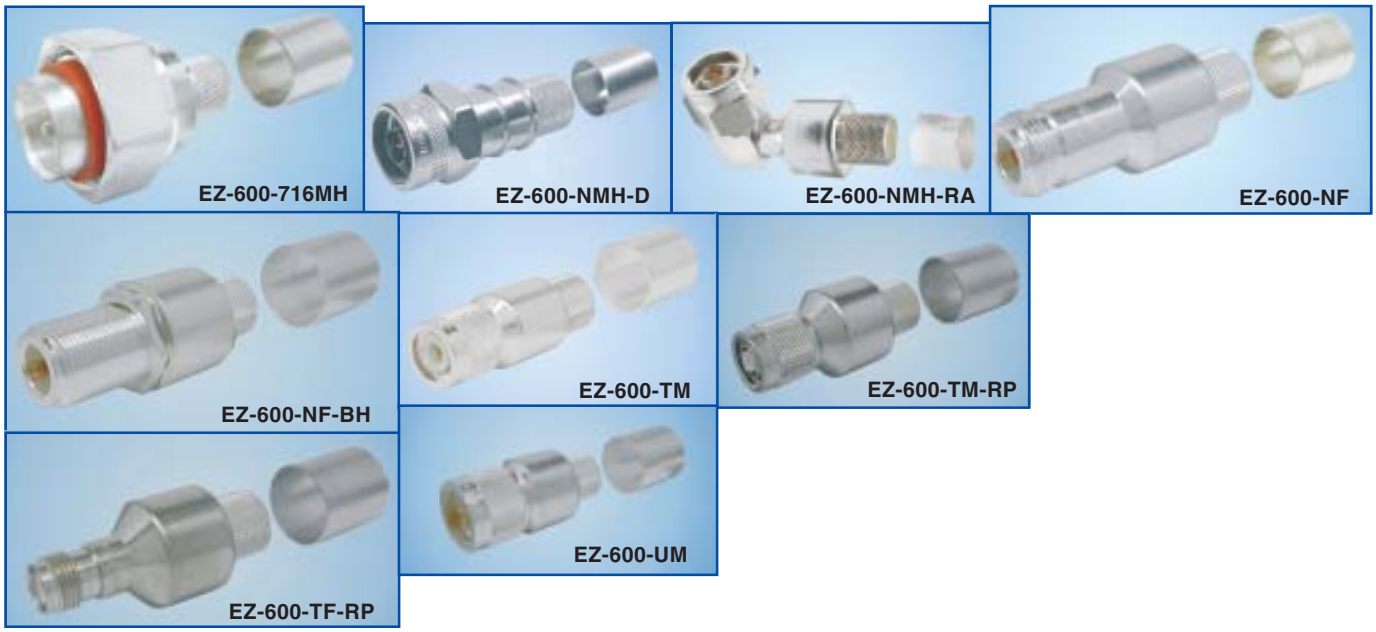
Electrical Specifications			
Performance Property	Units	US	(metric)
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.87)
Impedance	ohms	50	
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	6000	

Loss & Coupling vs. Frequency **(typical)**



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.34	2.22	3.35	5.30	6.40
Attenuation dB/100 m	4.39	7.28	10.98	17.38	20.99
Coupling Loss** dB	54	61	68	69	67

* Request T-RAD-600 connector data sheet and attachment instructions
** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in	Length (mm)	Width in	Width (mm)	Weight lb	Weight (g)
7-16 DIN Male	Straight Plug	EZ-600-716-MH	3190-503	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/S	2.0	(51)	1.30	(33.0)	0.254	(115.2)
N Male	Straight Plug	EZ-600-NMH-D	3190-1268	<1.25:1 (2.5)	Hex/Knurl	Spring Finger	Crimp	A/G	2.1	(53)	0.92	(23.4)	1.164	(74.4)
	Right Angle	EZ-600-NMH-RA	3190-762	<1.35:1 (6)	Hex	Spring Finger	Crimp	S/G	2.1	(53)	0.92	(23.4)	0.185	(83.9)
N Female	Straight Jack	EZ-600-NF	3190-955	<1.25:1 (2.5)	NA	Spring Finger	Crimp	S/G	2.3	(59)	0.87	(22.1)	0.150	(68.0)
	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (2.5)	NA	Spring Finger	Crimp	S/G	2.4	(61)	0.88	(22.4)	0.195	(88.5)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	1.7	(43)	0.59	(15.0)	0.112	(50.8)
	Reverse Polarity	EZ-600-TM-RP	3190-796	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	2.2	(56)	0.87	(22.0)	0.112	(50.8)
TNC Female	Reverse Polarity	EZ-600-TF-RP	3190-797	<1.25:1 (2.5)	NA	Spring Finger	Crimp	A/G	2.3	(58)	0.87	(22.0)	0.100	(45.4)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	1.7	(43)	0.88	(22.4)	0.164	(74.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

TIMES MICROWAVE SYSTEMS

Engineered Products:

SilverLine™ - QMA

Motorola Approved!

ISO 9001 Certified

Professional Grade Test Cables and Adaptors

Fast, reliable, repeatable RF test measurements for hand held and mobile radios.

- *Motorola*
- *Kenwood*
- *Vertex Standard*
- *ICOM*
- *EF Johnson*
- *M/A COM*
- *Others*

SilverLine™-QMA test cables and adaptors eliminate uncertainties in RF power output and sensitivity measurements associated with BNC adaptors.

The system consists of a high frequency, phase stable, QMA-equipped test cable and various mating adaptors designed to fit most manufacturers' hand held and mobile radios. The "snap-on, pull-off" design is extremely secure when mated. Each half can rotate 360° relative to its mate yet together they exhibit little or no change in RF performance.

SilverLine™ test cables have an extra heavy duty connector attachment system and an unparalleled reputation with the largest radio and RF test equipment manufacturers in the world as a very long life, rugged yet value-priced coax test cable.

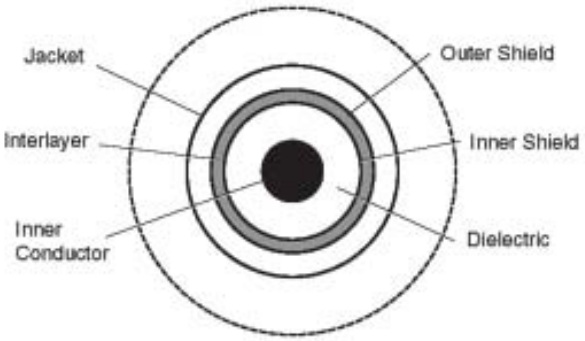
Features & Benefits:

- 2500* Mating Life Cycle
- High Flex Life, Phase Stable Coax
- Triple Shielded Cable
- Robust Connector Attachment System
- Stainless Steel Connectors and Adaptors
- Rugged, Solder-Clamp Attachment
- **ROHS Compliant**

Time's ***Silverline***™ Product Guarantee

Times will repair or replace your SilverLine test cable at its option if the connector attachment fails within four months of shipment. This guarantee excludes cable or connector interface damage from misuse or abuse.

SilverLine™ - QMA Specifications:



Cable Construction

Inner Conductor: Solid Silver Plated Copper Clad Steel

Dielectric: Solid PTFE

Shield: Silver-Plated Copper Flat Ribbon Braid
Aluminum-Polyimide Tape Interlayer
36 GA Silver-Plated Copper Braid (90%k)

Jacket: Clear FEP

Connectors

- Passivated stainless steel finish
  (QMA coupling nut nickel plated brass)
- QMA SureGrip™ coupling nut design
- Captive contact
- Knurl/hex coupling nut Type N
- PTFE dielectric

Connector Attachment/Strain Relief

- Rugged, solder-clamp to braid. 175 lb pull force
- Redundant triple layer strain relief system

Physical & Mechanical Specifications		
Bend Radius: minimum	1 in	25 mm
Connector Retention	> 175 lbs	
Mating Life Cycle	Type N: > 5000* QMA: > 2500†	
Length Tolerances	< 2 ft. or 0.75m, -0, +0.50" (12.7mm) > 2 ft. or 0.75m, -0, +2% of length	

Electrical Specifications			
VSWR Max		4 GHz	6 GHz
	BNC	1.20:1	
	Type N, QMA		1.25:1
Impedance	50 ohms		
Velocity of Propagation	70 %		
Shielding Effectiveness	>100 dB		
Capacitance	29.4 pf/ft = 96.4 pf/meter		
Phase Stability (ten, 4" radius, 180° reverse bends)	DC to 6 GHz: +/- 1.1°		

Attenuation Max @ +77°F (+25°C)		
Attenuation (GHz)	dB/100 ft	dB/100 m
1	12.2	40.0
2	18.0	59.0
6	34.2	112
12	52.5	172
18	68.4	224
26.5	88.7	290

Power Handling @ +77°F (+25°C) (Sea Level) (Cable Only*)**	
Power Handling (GHz)	Watts (max.)
0.4	891
1	539
2	363
6	180
12	151
18	120
26.5	60

** Type N: Assumes use of calibrated torque wrench, proper care and cleaning of interface and mated connector is within mil spec limits.*

† QMA: Assumes proper use, care and cleaning.

**** Connector configuration may limit cable assembly maximum power handling capability.*

Specifications subject to change without notice.

TIMES MICROWAVE SYSTEMS

Engineered Products:

Ordering Information

Test Cables Only

SLU04-BMQMM-03.00F = BNC male - QMA male, 3 ft long
SLU06-NMQMM-03.00F = N male - QMA male, 3 ft long
SLU06-QMMQMM-03.00F = QMA male - QMA male, 3 ft long

Other connector configurations and lengths available upon request

Adaptor Kits Only

Shop Kit pn 66573EA

Adaptors for most manufacturer's hand held and mobile radios including:

3191-133EA (SMA plug)
3191-136EA (XTS antenna style)
3191-141EA (Lengthened Mini-UHF plug)
3191-143EA (Type N plug)
3191-144EA (CP200 & PR400 antenna style)
3191-145EA (CT250 antenna style)
3191-146EA (P1225 antenna style)
3191-184EA (PL259 plug)
3191-186EA (ICOM J-Plug)
3191-191EA (M/A-COM)
3190-2169EA (Hard carry case)

Field Kit pn 66574EA

Adaptors to meet most field applications including:

3191-133EA (SMA plug)
3191-134EA (SMA jack)
3191-141EA (Lengthened Mini-UHF plug)
3191-143EA (Type N plug)
3191-148EA (TNC plug)
3191-182EA (Mini-UHF jack)
3191-183EA (PL259 jack)
3191-184EA (PL259 plug)
3191-187EA (BNC plug)
3191-188EA (BNC jack)
3191-189EA (Type N jack)
3191-190EA (N plug-QMA plug between series)
3191-192EA (SMB plug, also fits Fakra)
3191-195EA (SMA plug-QMA plug between series)
3191-196EA (SMB jack, also fits Fakra)
3190-584 (Heavy duty, soft suede pouch)

Ordering Notes

1. *All kits contain two of each adaptor.*
2. *All adaptors are QMA jack one side (except between series).*
3. *3191-194 SMA reverse polarity and 3191-193 TNC reverse polarity are separate order items.*
4. *The maximum frequency of operation for each adaptor interface series is specified by US industry standards.*

Individual Adaptors, Cases & Tools See Page 4

Operating Instructions

To operate: Grasp cable along strain relief boots with last three fingers. Grasp O-ring between thumb and index finger and pull back on coupling nut before disengaging from adaptor.

Engineered Products:

Separate Order Adaptors, Cases & Tools

All Times QMA adaptors are fabricated from the highest quality stainless steel for superior performance and extra long life.

SMA Jack
(Motorola Modified)
3191-136EA

(Motorola)
3191-144EA

(Motorola)
3191-146EA

Mini-UHF Plug
(Lengthened)
3191-141EA

Mini-UHF Jack
3191-182EA

(Motorola)
3191-145EA

TNC Plug
3191-148EA

TNC
Reverse polarity
3191-193EA

N plug-QMA
plug between series
3191-190EA

Type N Plug
3191-143EA

Type N Jack
3191-189EA

SMA plug-QMA
plug between series
3191-195EA

SMA Plug
3191-133EA

SMA
Reverse polarity
3191-194EA

SMA Jack
(Standard)
3191-134EA

PL259 Plug
3191-184EA

PL259 Jack
3191-183EA

BNC Plug
3191-187EA

BNC Jack
3191-188EA

SMB Plug
3191-192EA

SMB Jack
3191-196EA

M/A-COM
3191-191EA

ICOM J-Plug
3191-186EA

Release Tool
(High Volume Testing)
3190-1941EA

Case for Kit 66573EA
(Order pn 3190-2169EA)

Field Pouch for Kit 66574EA
(Order pn 3190-584)

Shop case is blow molded, dual walled, high impact, padlockable construction. It is impervious to gas, oil, grease and most chemicals.It features a long life cover and dense foam inserts that securely hold adaptors even during rough handling. UPS and airline approved. Field kit pouches are heavy duty, cut-resistant suede with a sturdy, lockable, wide-mouthed zipper access.

TIMES MICROWAVE SYSTEMS

Engineered Products:

SilverLine-TG™

Coax Test Cables

TuffGrip™ ISO 9001 Certified

For Wireless System Testing:

- *Antenna & Cable Test*
- *Troubleshooting*
- *RF Maintenance*
- *Field RF Test*

Anritsu SiteMaster™ courtesy of Anritsu Co.

Photo courtesy of Bird Technologies Group

SilverLine-TG™ (***TuffGrip***™) test cables (patent pending) are designed to address the needs of cellular infrastructure, wireless Internet and land mobile radio installers and test technicians. They employ a unique, hefty hand grip to help withstand the rigors of field use.

The robust ***TuffGrip***™ hand grip is installed at the system test end of the cable assembly. It allows the user to apply as much resistance as is necessary to properly torque the system cable connector, while preventing excess torque from being applied to the test cable. A proper connection may now be made quickly with a single wrench.

TuffGrip™ test cables are armored and use super-tough stainless steel captive-contact connectors for long life. Each is 100% RF tested and comes with Times' replacement guarantee.

Features & Benefits:

- Phase, VSWR and Loss Stable
- Super Rugged Construction
- Triple Shielded, High Flex Life Coax Cable
- High Frequency Operation

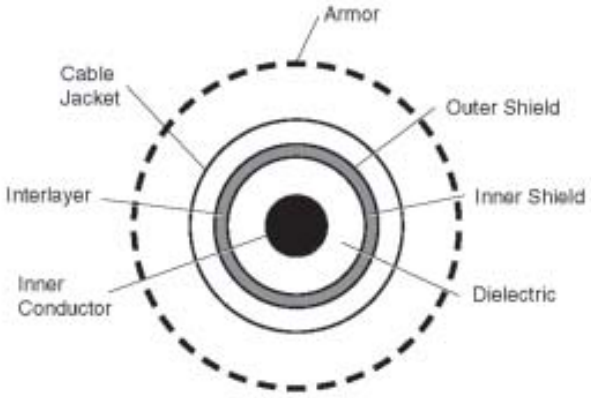
1 Year Guarantee!

Times' ***SilverLine-TG***™ Replacement Guarantee

Times will repair or replace your SilverLine-TG test cable at its option if the connector attachment fails within one year of shipment. Excludes cable or connector interface damage from misuse or abuse.

Engineered Products:

SilverLine-TG™ Specifications:



Cable Construction

Inner Conductor: Solid Silver Plated Copper Clad Steel

Dielectric: Solid PTFE

Shield: Silver-Plated Copper Flat Ribbon Braid
Aluminum-Polyimide Tape Interlayer
36 GA Silver-Plated Copper Round Braid (90%k)

Jacket: Clear FEP

Armor: Full, 100% non-interleaved spiral steel sheath overlaid with captured, apposing-force structure for anti-torque resistance. Water, crush and UV resistant. Black polyurethane outer jacket.

Connectors

- Passivated stainless steel finish
- Captive contact
- Precision grade 7-16 interface
- Knurl/hex Type N coupling nut

Connector Attachment

- System side: TuffGrip™ (patented)
- Analyzer side: solder/clamp/crimp

Ordering Information

SLSXX-NMXXX-XX.XXM

)6 = 6 GHz
18 =18 GHz (NMNFG only)

NM = Type N male
NFG = N female TuffGrip™
7MG = 7-16 male TuffGrip™
7FG = 7-16 female TuffGrip™

01.50 = 1.5 m
03.00 = 3.0 m
05.00 = 5.0 m
Meters

TuffGrip™			
Mechanical Specifications			
Dimensions	in	mm	
Armor O.D.	0.430	10.92	
Min Bend Radius	2.50	6.35	
Connector Retention	> 290 lbs.		
Armor Crush Resistance	> 1200 lbs. per linear inch		
Mating Life Cycle	> 5,000*		
Flex Life	> 50,000**		
Temperature Range	-67°/+185°F	-55°/+85°C	
Electrical Specifications			
Impedance	50 ohms		
Velocity of Propagation	70 %		
Shielding Effectiveness	>100 dB		
Capacitance	29.4 pf/ft = 96.4 pf/meter		
Phase Stability (ten, 4" radius, 180° reverse bends)	DC to 10 GHz: +/- 1.1° 10 to 18 GHz: +/- 2.0°		
VSWR Max		6 GHz	18 GHz
	Type N	1.20:1	1.35:1
	7-16	1.25:1	
Attenuation Max @ +77°F (+25°C)			
Frequency (GHz)	dB/100 ft	dB/100 m	
1.0	12.2	40.0	
2.0	18.0	59.0	
6.0	34.2	112.0	
18.0	68.4	224.0	
Power Handling @ +77°F (+25°C) (Sea Level) (Cable Only***)			
Frequency (GHz)	Watts (max.)		
1	539		
2	363		
6	180		
18	88		

Specifications subject to change without notice.
**Assumes the use of a calibrated torque wrench, proper care and cleaning of interface, and mated connector is within mil spec limits.*
*** Minimum bend radius not to be exceeded.*
**** Connector configuration may limit cable assembly maximum power handling capability.*

Adaptors "All Stainless Steel, Precision Grade"

3191-180EA = 7-16 female-7-16 female (1.08:1 max VSWR through 6 Ghz)
3191-212EA = N male-N male (1.15:1 max VSWR through 18 Ghz)
3191-221EA = N female-N female (1.15:1 max VSWR through 18 Ghz)
3191-222EA = N male-7-16 female (1.10:1 max VSWR through 6 Ghz)
3191-223EA = N male-7-16 male (1.10:1 max VSWR through 6 Ghz)

TIMES MICROWAVE SYSTEMS

Engineered Products:

Bundled cables

High quality LMR® Low Loss flexible 50 Ohm coax feeder cable, bundled under a common outer jacket for multiple run applications

- Smart antenna feeders
- IF & RF runs to tower mounted amplifiers for cellular, point to point, broadcast wireless or WiMax systems

• **LMR® Bundled Cable** is a spiral configuration of multiple LMR-400 or smaller LMR cables under a common polyethylene outer jacket. This innovative design acts as the perfect feeder cable for applications requiring multiple runs, such as on towers or building top sites. A unique, patented grounding fixture grounds the outer shields of each cable and a molded end cap seals the bundle to prevent moisture ingress at the break-out point.

• **LMR Bundled Cable** reduces installation time and grounding hardware costs, while improving long term reliability. Compared to individual cable runs, LMR Bundled Cable greatly reduces installation cost by cutting labor time and accessory requirements.

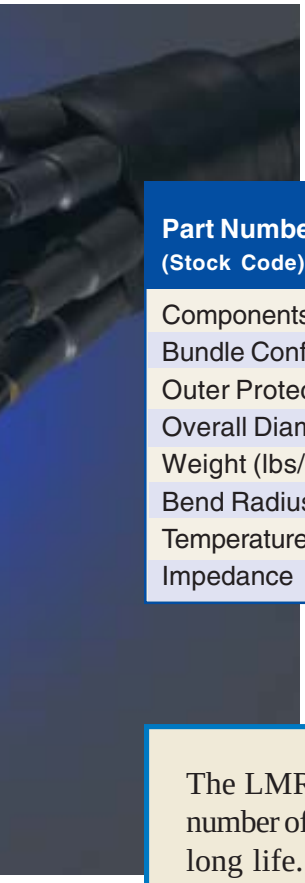
• **LMR Bundled Cable** can be supplied as complete assemblies with full technical support and custom tools. Pictorial instructions and installation videos are also available.

• **Features and Benefits:**

- Less cable runs
- Fewer ground kits and cable clamps to install
- Reduced labor and material costs
- Standard cables include:
  - BC400-9-LW (9 runs of LMR-LW400)
  - BC400-9 (9 runs of LMR-400)
  - BC400-7 (7 runs of LMR-400)
  - BV400-4 (4 runs of LMR-400)
  - BC200FR-6-OS (6 runs of LMR-200-FR)

Consult factory for other or custom configurations.

Attenuation dB/100 ft					
Frequency (MHz)	**150**	**450**	**900**	**2000**	**2500**
BC200FR-6-OS	4.1	7.2	10.2	15.5	17.4
BC400-4	1.5	2.8	4.0	6.2	7.0
BC400-7	1.5	2.8	4.0	6.2	7.0
BC400-9	1.5	2.8	4.0	6.2	7.0
BC400-9-LW	1.5	2.8	4.0	6.2	7.0



Bundled Cable Specifications

Part Number (Stock Code)	BC200FR-6-OS (31834)	BC400-4 (31832)	BC400-7 (31836)	BC400-9 (31831)	BC400-9-LW (31833)
Components	LMR-200-FR	LMR-400	LMR-400	LMR-400	LMR-LW400
Bundle Configuration	F-6	F-4	1-6	1-8	1-8
Outer Protection	Braid & FR Jacket	Jacket	Jacket	Jacket	Jacket
Overall Diameter (in)	.709	1.060	1.350	1.575	1.575
Weight (lbs/ft)	.25	.37	.63	.75	.67
Bend Radius (in)	7	10	14	16	16
Temperature Range	-40ºF to + 185ºF (-40ºC to + 85ºC)				
Impedance	50 Ohms				

Install Tools

The LMR bundled cable tool package contains a number of unique products designed for easy use and long life. The ST-BC-1 and ST-BC-2 make up a universal outer sheath removal tool set that can be used with any of our bundled cables. If working with the BC400-7 and BC400-9, the GST-BC400-7 and GST-BC400-9 respectively are the best value, both economically and for ease of use.

The GST-400A easily accomplishes the otherwise challenging task of removing the inner cable' outer jacket from the BC400 bundled cables series. This tool is only needed when installing ground features.

GST-BC400-9:
Custom designed to quickly remove the outer sheath of the BC400-9 cable.

ST-BC-2:
Can be used in combination with the ST-BC-1 to remove the outer sheath of a bundled cable for grounding or fan out.

ST-BC-1:
Can be used in combination with the ST-BC-2 to remove the outer sheath of a bundled cable for grounding or fan out.

GST-400A:
Custom designed to quickly remove the outer jacket of the individual internal cables of LMR-400 based bundled cables.

TIMES MICROWAVE SYSTEMS

Engineered Products:

Bundled cables

Grounding Kit


GK-BC400-9

All outdoor antenna feeder runs should be grounded at their lowest point just prior to entering the base station or radio enclosure. Depending on the height of the tower run, additional ground points may be required (see table below)

Tower Height (TH)	Location of Additional Grounds*	Comments
<30 meters	No additional GKs required	
30-59 meters	TH/2	1 additional GK
60-69 meters	TH/3 and (TH/3)(2)	2 additional GKs

** These locations are referenced from the base of the tower*

Times Microwave Systems has developed a unique, patented grounding fixture that is both economical and easy to install. This ground fixture effectively grounds all the individual cables in the bundle, while requiring only one cable per fixture to be bonded to the tower.

Grounding

1) The outer conductors of individual cables must be grounded/bonded to an adequate ground.

2) All installations regardless of tower height (TH) should be grounded just prior to entering the equipment building or shelter. The cable should also be grounded at the tower base. The ground at the tower base and just prior to building entry should be as close to the ground plane as possible.

3) For towers greater than 30 meters high, additional grounding is required.

End Cap Kit


EC-BC400-9

Times Microwave Systems offers weather seal break out boot kits for a number of the LMR bundled cables. These kits consist of a Neoprene boot, which slides over the individual cables and snugly slips over the outer jacket of the bundled cable. Adhesive lined ATUM shrink boots are then used to seal the boot to the jacket of the individual and

bundled cables. Heat in excess of 125^{o} C is required to shrink the ATUM boots.

TIMES MICROWAVE SYSTEMS

Grounded LMR Bundled Cable

Weather Seal Kit

WK-TBC

It is important that the ground kit be properly weather sealed. This bundled cable process provides labor savings and increased reliability. Composed of six rolls of Butyl Rubber tape and three rolls of black poly vinyl tape, the WK-TBC Weather Seal Kit provides everything necessary to properly seal one installed ground fixture.

Tools and Install Accessories

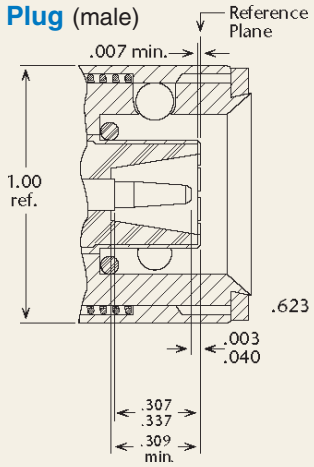
Type	Part Number	Description
Bundle Jacket Strip Tool	ST-BC-1 & ST-BC-2	Bundle jacket strip tool for BC200FR-6-05 and BC400-4 cables
	GST-BC400-7	Bundle jacket strip tool for BC400-7 cables
	GST-BC400-9	Bundle jacket strip tool for BC400-9 and BC400-9-LW cables
Individual Coax Strip Tool	GST-400A	Individual coax strip tool for BC400-4, BC400-7, BC400-9 and BC400-9-LW cables *(N/A for BC200FR-6-OS cables)*
Hangers	SH-U600T	Hangers for BC200FR-6-OS cables
	SH-U1200T	Hangers for BC400-4 cables
	SH-U1700T	Hangers for BC400-9 and BC400-9-LW cables *(BC400-7 is 1-1/4" cable compatible)*
Hoisting Grips	HG-600T	Hoisting grips for BC200FR-6-OS cables
	HG-1200T	Hoisting grips for BC400-4 cables
	HG-1700T	Hoisting for BC400-9 and BC400-9-LW cables *(BC400-7 is 1-1/4" cable compatible)*

TIMES MICROWAVE SYSTEMS

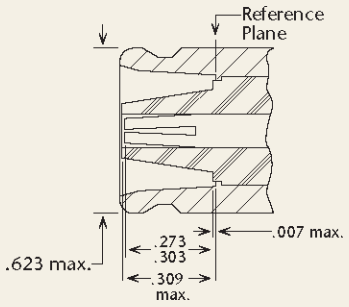
Connector Interface Guide

BNC Connectors

Plug (male)

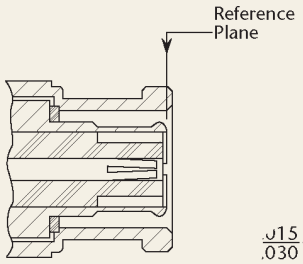


Jack (female)

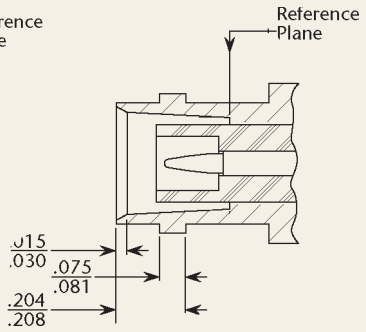


BNC-RP (Reverse Polarity) Connectors

Plug (male)

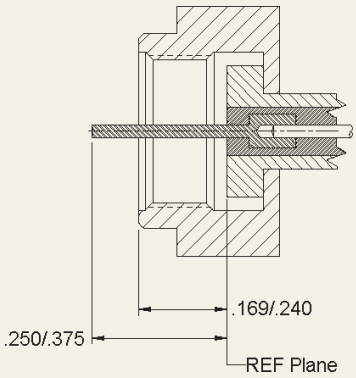


Jack (female)

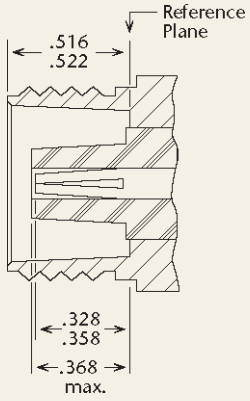


F Connectors

Plug (male)

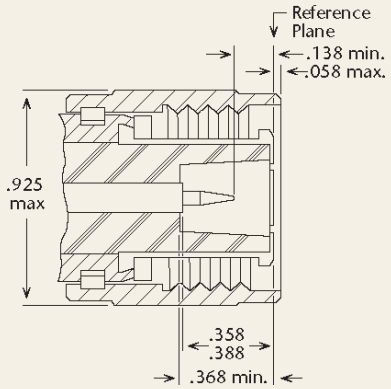


Jack (female)

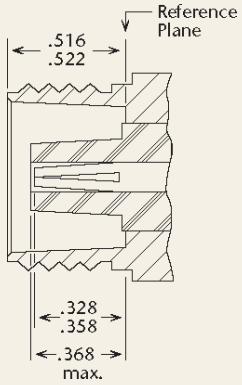


HN Connectors

Plug (male)

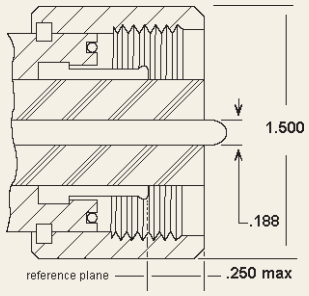


Jack (female)

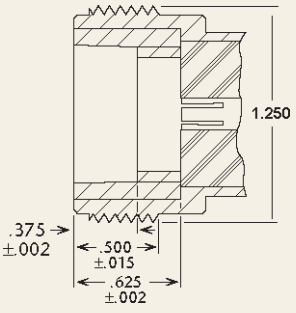


LC Connectors

Plug (male)



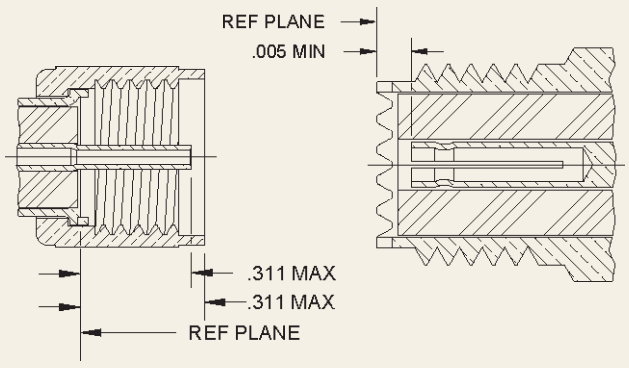
Jack (female)



MUHF Connectors

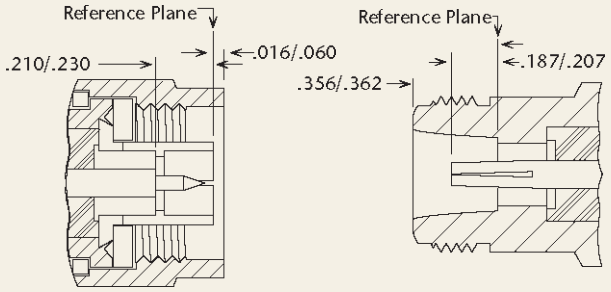
Plug (male)

Jack (female)



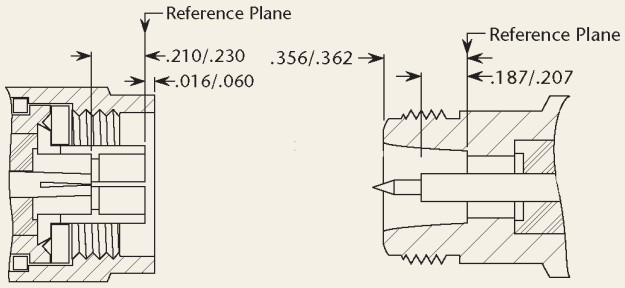
N Connectors

Plug (male) **Jack** (female)



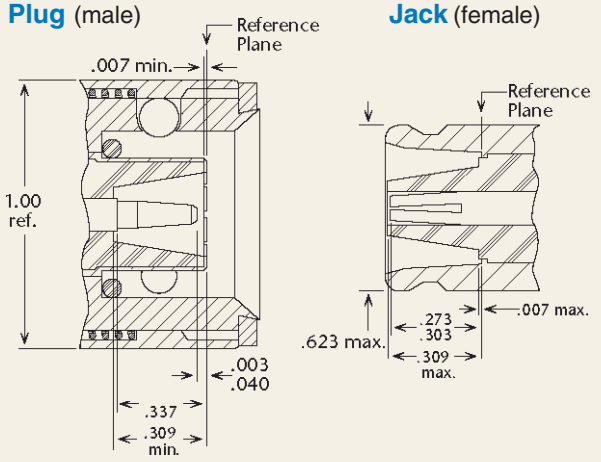
N-RP (Reverse Polarity) Connectors

Plug (male) **Jack** (female)



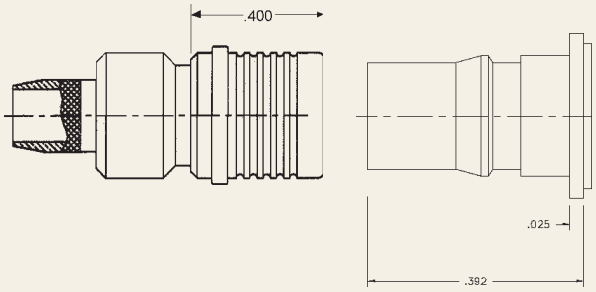
QDS Connectors

Plug (male) **Jack** (female)



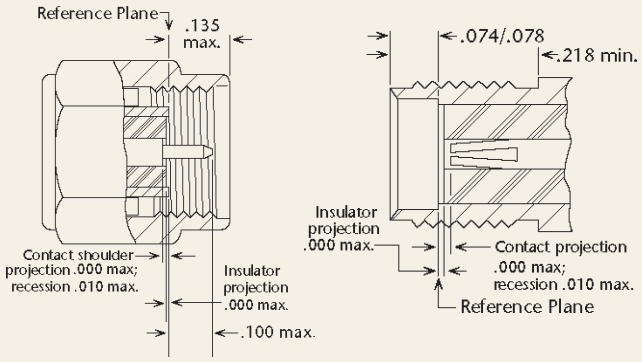
QMA Connectors

Plug (male) **Jack** (female)



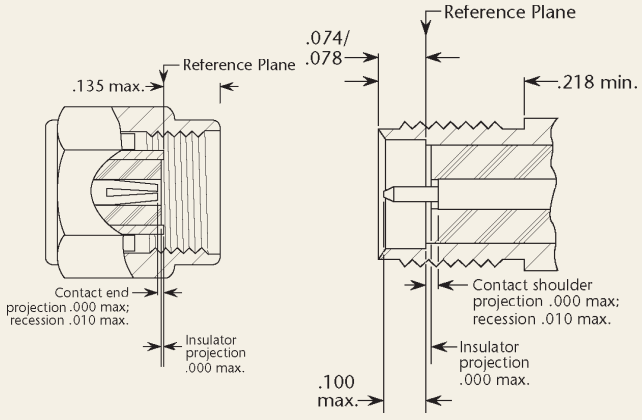
SMA Connectors

Plug (male) **Jack** (female)



SMA-RP (Reverse Polarity) Connectors

Plug (male) **Jack** (female)

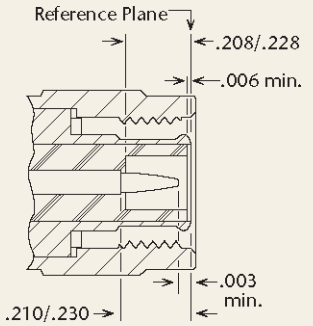


TIMES MICROWAVE SYSTEMS

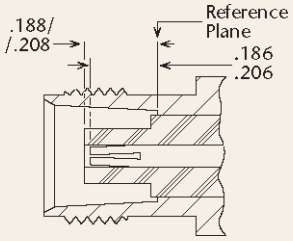
Connector Interface Guide

TNC Connectors

Plug (male)

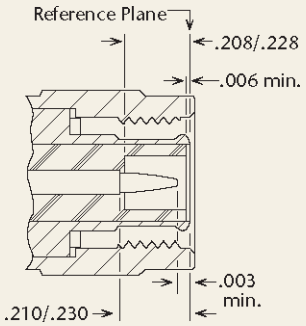


Jack (female)

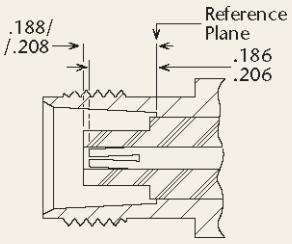


TNC-RP (Reverse Polarity) Connectors

Plug (male)

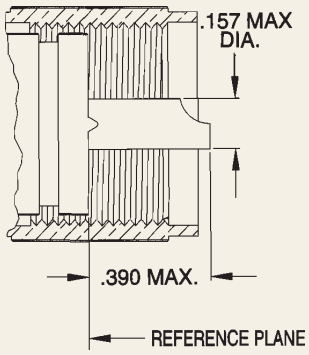


Jack (female)

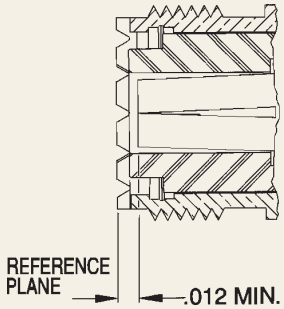


UHF Connectors

Plug (male)

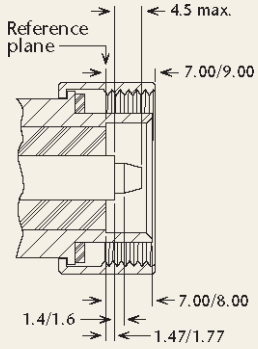


Jack (female)

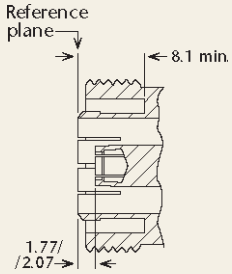


7/16 DIN Connectors

Plug (male)

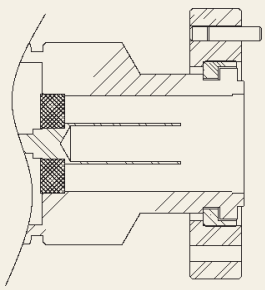


Jack (female)

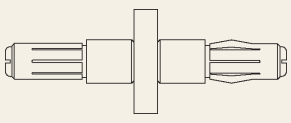


7/8 EIA Connectors

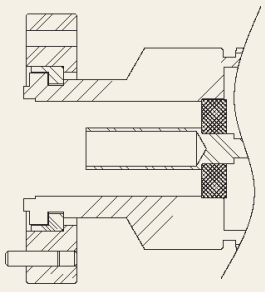
Jack (female)



Male - Male Bullet



Jack (female)



Materials Abbreviations Legend

CONDUCTORS & BRAID MATERIALS

AL ..... Aluminum
BC ..... Bare Copper
BeCu ..... Beryllium-Copper Alloy 172
BCCAI ..... Bare Copper Clad Aluminum
CCS ..... Bare Copper Clad Steel
GS ..... Galvanized Steel
HR ..... High Resistance Wire
MW ..... Magnet Wire
NC ..... Nickel Covered Copper
SA ..... Silver Covered Alloy
SC ..... Silver Covered Copper
SCBeCu ..... Silver Covered Beryllium Copper
SCCadBr ..... Silver Covered Cadmium Bronze
SCCAl ..... Silver Covered Copper Clad Aluminum
SCCS ..... Silver Covered Copper Clad Steel
SNCCS ..... Silver Covered Nickel Covered Copper Clad Steel
SCS ..... Silver Covered Copper Strip
TC ..... Tinned Copper
TCCS ..... Tinned Copper Clad Steel

DIELECTRIC MATERIALS

PE ..... Solid Low Density Polyethylene
PTFE ..... Solid Polytetrafluoroethylene
LDTFE ..... Low Density PTFE
Foam PE ..... Gas Injected Foam PE
FEP ..... Solid Fluorinated Ethylene Propylene
CPT ..... Conductive PTFE
CPE ..... Conductive Polyethylene (Type A-5 per MIL-C-17)
Rubber ..... per MIL-C-17 (obsolete)
MGO ..... Magnesium Oxide (SiO_2)

INTERLAYER MATERIALS

PE ..... Solid Polyethylene
PTFE ..... Solid Polytetrafluoroethylene
MY ..... Polyester
KP ..... Polyimide
ALMY ..... Aluminum-Polyester Laminate
ALKP ..... Aluminum-Polyimide Laminate
CPC ..... Copper-Polyester-Copper Laminate

JACKET MATERIALS

E-CTFE ..... Ethylene Chlorotrifluoroethylene
Type XI per MIL-C-17
ETFE ..... Ethylene Tetrafluoroethylene Copolymer
Type X per MIL-C-17
FEP ..... Fluorinated Ethylene Propylene
Type IX per MIN-C-17
FG Braid ..... Fiberglass; Impregnated
Type V per MIL-C-17
PE ..... Clear Polyethylene
Type III per MIL-C-17
LS/LT ..... Low Smoke/Low Toxicity
(XLPE)
PE ..... Polyethylene, black HMW
Type IIIA per MIL-C-17
PFA ..... Perfluoroalkoxy
Type XIII per MIL-C-17
PTFE ..... Polytetrafluoroethylene
Type VIIA per MIL-C-17
PUR ..... Polyurethane, black
Type XII per MIL-C-17
PVC-I ..... Polyvinyl Chloride, black (contaminating)
Type 1 per MIL-C-17
PVC-II ..... Polyvinyl Chloride, grey (non-contaminating)
Type II per MIL-C-17
PVC-IIA ..... Polyvinyl Chloride, black (non-contaminating)
Type IIA per MIL-C-17
Rubber Per MIL-C-17 (obsolete)
SIL/DAC ..... Dacron Braid over Silicone Rubber
Type VI per MIL-C-17
TPE ..... Thermo Plastic Elastomer
XLPE ..... Crosslinked Polyolefin
Type XIV per MIL-C-17

Coaxial Cable Equations Legend

Symbol	Definition	Units	Symbol	Definition	Units
α	= Attenuation in dB/100 feet	dB/100 feet	**Fco**	= Cutoff frequency	GHz
ε	= Dielectric constant		**C**	= Braid carriers	
Γ	= Reflection coefficient		**N**	= Braid ends per carrier	
ϕ	= Electrical length	degrees	**t**	= Flat strip thickness	inches
C	= capacitance	pF/foot	**w**	= Flat strip width	inches
L	= Inductance	uH/foot	**SRL**	= Return loss	dB
Zo	= Impedance	ohms	**VSWR**	= Voltage standing wave ratio	
Vp	= Velocity of propagation	%	**FWD**	= Forward power	dB
df	= Dissipation factor		**RFL**	= Reflected power	dB
Td	= Time delay	nS/foot	**MML**	= Mismatch loss	dB
F	= Frequency	MHz	**ME**	= Match efficiency	%
PTC	= Phase temperature coefficient	ppm/C	$\mathbf{k_s}$	= 1.0 for solid center conductor	
Δ**T**	= Change in temperature (t2 t0 t1)	C		= 0.939 for 7 strand center conductor	
LTH	= Length	feet		= 0.97 for 19 strand center conductor	
$\Delta\phi$	= Change in electrical length (t1 to t2)	degrees	**log**	= logarithm to base 10	
D	= dielectric diameter	inches	**ln**	= logarithm to base e	
d	= center conductor diameter	inches	$\mathbf{k_1}$	= resistive loss constant	
ds	= Braid wire size	inches	$\mathbf{k_2}$	= dielectric loss constant	
Fbd	= Braid factor				

TIMES MICROWAVE SYSTEMS

Coax Cable Design Equations

Impedance (ohms)

$$Z_0 = 138\, V_p \log\left(\frac{D}{d \bullet k_s}\right) = 60\, V_p \ln\left(\frac{D}{d \bullet k_s}\right)$$

$$Z_0 = \frac{138}{\sqrt{\varepsilon}} \log\left(\frac{D}{d \bullet k_s}\right) = \frac{60}{\sqrt{\varepsilon}} \ln\left(\frac{D}{d \bullet k_s}\right)$$

$$Z_0 = \sqrt{\frac{L}{C}}$$

Velocity of Propagation and Dielectric Constant

$$V_P = \frac{1}{\sqrt{\varepsilon}} \quad \varepsilon = \frac{1}{V_P^2}$$

Time Delay (nS/foot)

$$Td = \frac{1.016}{V_P} = 1.016\sqrt{\varepsilon}$$

Capacitance (pF/foot)

$$C = \frac{7.36\varepsilon}{\log\left(\frac{D}{d \bullet k_s}\right)} = \frac{16.95\varepsilon}{\ln\left(\frac{D}{d \bullet k_s}\right)}$$

$$C = \frac{7.36}{V_P^2 \log\left(\frac{D}{d \bullet k_s}\right)} = \frac{16.95}{V_P^2 \ln\left(\frac{D}{d \bullet k_s}\right)}$$

$$C = \frac{1016}{Z_0 \bullet V_P}$$

Inductance (uH/foot)

$$L = .140 \log\left(\frac{D}{d \bullet ks}\right) = .0606 \ln\left(\frac{D}{d \bullet ks}\right)$$

$$L = \frac{Z_0^2 \bullet C}{1 \times 10^6}$$

Attenuation (dB/foot)

$$\alpha = \frac{.4343}{Z_0 \bullet D}\left[\frac{D}{d \bullet ks} + Fbd\right]\sqrt{F} + \frac{2.78 \bullet df \bullet F}{V_P}$$

$$\alpha = k_1\sqrt{F} + k_2 F$$

Braid Factor

Round Wire Braid: $Fbd = \frac{8D + 16\, ds}{C \bullet N \bullet ds}$

Flat Strip Braid: $Fbd = \frac{2\pi\,(D + 2t)}{C \bullet W}$

Solid Tube: $Fbd = 1.0$

Cutoff Frequency (GHz)

$$Fco = \frac{7.5 \bullet Vp}{(D + (d \bullet ks)}$$

$$Fco = \frac{7.5}{\sqrt{\varepsilon}\,(D + (d \bullet ks)}$$

Electrical Length (degrees)

$$\phi = \frac{360 \bullet F \bullet L_{TH}}{984 \bullet V_p}$$

$$\phi = \frac{360 \bullet F \bullet L_{TH} \bullet \sqrt{\varepsilon}}{984}$$

Phase Temperature Coefficient (ppm/C°)

$$PTC = \frac{\Delta\phi \bullet 1 \times 10^6}{\phi \bullet \Delta T}$$

Phase Stability (degrees)

$$Df = \frac{PTC \bullet \phi \bullet \Delta T}{1 \times 10^6}$$

Return Loss (dB)

$$RL = -20 \log \Gamma$$

$$RL = -20 \log \frac{VSWR-1}{VSWR+1}$$

$$RL = -10 \log \frac{RFL}{FWD}$$

VSWR

$$VSWR = \frac{1 + \Gamma}{1 - \Gamma}$$

$$VSWR = \frac{1 + 10^{RL/20}}{1 - 10^{RL/20}}$$

$$VSWR = \frac{1 + \sqrt{RFL/FWD}}{1 - \sqrt{RFL/FWD}}$$

Reflection Coefficient

$$\Gamma = 10^{-RL/20}$$

$$\Gamma = \frac{VSWR - 1}{VSWR + 1}$$

$$\Gamma = \sqrt{RFL/FWD}$$

Match Efficiency (%)

$$ME = (1 - \Gamma^2) \bullet 100$$

$$ME = \left[1 - \left(\frac{VSWR - 1}{VSWR + 1}\right)^2\right] \bullet 100$$

$$ME = \left(\frac{FWD-REL}{FWD}\right) \bullet 100$$

Match Efficiency (%)

$$MML = -10 \log (1 - \Gamma^2)$$

$$MML = -10 \log \left[1 - \left(\frac{VSWR-1}{VSWR+1}\right)^2\right]$$

$$MML = -10 \log \left(1 - \frac{RFL}{FWD}\right)$$

General Electrical Properties

	Cable Type	Impedance (ohms)	Capacitane (p/F/foot)	Velocity (%)	Dielecrtic Constant	Time Delay (nS/foot)
50 OHM	Solid Polyethylene	50	30.8	65.9	2.30	1.54
	Foam PE	50	24.5	83.0	1.45	1.22
	Foam PE	50	24.2	84.0	1.42	1.21
	Foam PE	50	23.9	85.0	1.38	1.20
	Foam PE	50	23.6	86.0	1.35	1.18
	Foam PE	50	23.3	87.0	1.32	1.17
	Foam PE	50	23.1	88.0	1.29	1.16
	Solid PTFE	50	29.2	69.5	2.07	1.46
	Tape PTFE	50	28.6	71.0	1.98	1.43
	Low Density PTFE	50	26.7	76.0	1.73	1.34
	Low Density PTFE	50	25.4	80.0	1.56	1.27
75 OHM	Solid Polyethylene	75	20.6	65.9	2.30	1.54
	Foam PE	75	16.3	83.0	1.45	1.22
	Foam PE	75	16.1	84.0	1.42	1.21
	Foam PE	75	15.9	85.0	1.38	1.20
	Foam PE	75	15.8	86.0	1.35	1.18
	Foam PE	75	15.6	87.0	1.32	1.17
	Foam PE	75	15.4	88.0	1.29	1.16
	Solid PTFE	75	19.5	69.5	2.07	1.46
	Low Density PTFE	75	17.8	76.0	1.73	1.34
	Low Density PTFE	75	16.9	80.0	1.56	1.27
MISC	Solid Polyethylene	95	16.2	65.9	2.30	1.54
	Foam PE	95	12.6	85.0	1.38	1.20
	Air Spaced PE	95	12.6	85.0	1.38	1.20
	Solid PTFE	95	15.4	69.5	2.07	1.46
	Air Spaced PE	125	09.6	85.0	1.38	1.20
	Air Spaced PE	185	06.5	85.0	1.38	1.20

Properties of Wire and Cable Insulating Materials

Material	Dielectric Constant	Dissipation Factor	Volume-Resistivity (ohm-cm)	Operating Temperature (Range °C)
PTFE	2.07	0.0003	10^{19th}	-75 to +250
Polyethylene	2.3	0.0003	10^{16th}	-65 to +80
Foam Polyethylene	1.29 - 1.64	0.0001	10^{12th}	-65 to +100
Polyvinylchloride	3.0 - 8.0	0.07 - 0.16	2×10^{12th}	-50 to +105
Polyamide	3.5 - 4.6	0.03 - 0.4	4×10^{14th}	-60 to +120
Silicone Rubber	2.1 - 3.5	0.007 - 0.016	10^{13th}	-70 to +250
Ethylene Propylene	2.24	0.00046	10^{17th}	-40 to +105
FEP	2.1	0.0007	10^{18th}	-70 to +200
Low Density PTFE	1.38 - 1.73	0.00005	10^{19th}	-75 to +250
Foam FEP	1.45	0.0007	10^{18th}	-75 to +200
Polyimide	3.0 - 3.5	0.002 - 0.003	10^{13th}	-75 to +300
PFA	2.1	0.001	10^{16th}	-75 to +260
ETFE	2.6	0.005	10^{16th}	-75 to +150
ECTFE	2.5	0.0015	10^{16th}	-65 to +150
PVDF	7.8	0.02	10^{14th}	-75 to +125

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A guide to the selection of RF coaxial cable

Choosing the best coaxial cable for a new application requires an understanding of the application and of the range of cables to choose from. The best choice can only be arrived at by a careful evaluation of the performance and cost trade-offs. Our in-depth expertise in all aspects of coaxial cable technology can help you to arrive at the best choice for your application.

Times Microwave Systems offers the broadest range of coaxial cables of any manufacturer. We also have the expertise to design and produce custom cables if there is no design available for your application.

In choosing the best coaxial cable for an application, the cable characteristics listed below should be considered. The following sections provide detailed discussions of each characteristic.

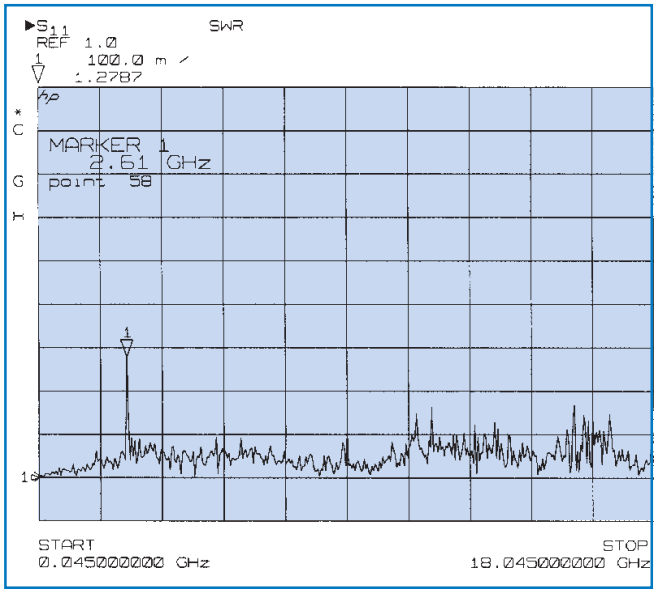
- **A:** Characteristic Impedance
- **B:** VSWR & Impedance Uniformity
- **C:** Attenuation
  - ·Attenuation Uniformity
  - ·Attenuation Stability
- **D:** Power Rating
- **E:** Operating Voltage
- **F:** Shielding
- **G:** Capacitance
- **H:** Velocity of Propagation
- **I:** Electrical Length Stability
- **J:** Cut-Off Frequency
- **K:** Pulse Response
- **L:** Self-Generated Cable Noise
- **M:** Operating Temperature Range
- **N:** Flexibility
- **O:** Environmental Resistance
- **P:** Cable Strength
- **Q:** Qualification & U L Approval

Table 1 provides various formulae describing cable characteristics.

A. CHARACTERISTIC IMPEDANCE

The characteristic impedance of a coaxial cable is determined by the ratio of the diameter of the outer conductor to the inner conductor and the dielectric constant of the insulating material between the conductors. Because the RF energy in the cable travels on the surface of the conductors, the important diameters are the outside diameter of the center conductor and the inside diameter of the outer conductor. Impedance is selected to match the system requirements.

Fig. 1
VSWR vs. Frequency



The most common coaxial cables impedances are 50, 75, and 95 ohm. Other impedances from 35 to 185 ohms are sometimes used. Fifty ohm cables are used in microwave and wireless communications applications. Seventy-five ohm cables are typically used in cable television applications and video applications. Ninety-five ohm cables are typically used for data transmission applications.

For best system performance, the cable must be selected to match the impedance of the other components in the system. Of the most commonly used coaxial cables, 75 ohms impedance provides the lowest attenuation and 35 ohms impedance provides the best power handling. For practical cables with non-ideal dielectrics and conductors, these differences are small. The availability of required

components and cables with the appropriate characteristic impedance is usually the prime factor in selecting a given system impedance.

B. SIGNAL REFLECTION: VSWR, RETURN LOSS, REFLECTION FACTOR & IMPEDANCE UNIFORMITY

There are three things that happen to RF energy input into a coaxial cable assembly:

1. It is transmitted to the other end of the cable, as is usually desired.
2. It is lost along the length of the cable either by being transformed into heat or by leaking out of the cable.
3. It is reflected back towards the input end of the cable.

Reflections back towards the input end of the cable are caused by variations in impedance along the length of the cable assembly. This includes differences in impedance between the cable and the devices to which it is attached. Typically the connectors and the interface between the connectors and the cable will be major contributors to the reflection. The cable itself can also contribute to the reflections. One source of cable reflections is periodic variations in impedance which result from the manufacturing process and add up at a specific frequency. When viewed in a sweep over a range of frequencies this will show up as a spike. An example of a spike is shown in Figure 1.

The magnitude of a reflection can be expressed in several ways. Perhaps the most familiar is VSWR or Voltage Standing Wave Ratio. A value of 1.0:1 or just 1.0 indicates no reflected power or a perfect cable. Alternatively, the reflection can be expressed as return loss—the ratio of the reflected power to the input power usually expressed in decibels. Table 1 gives the formulas to convert between VSWR, return loss and reflection coefficient. A tabulation of the equivalent values of all three measures is also provided in Table 2.

The lack of reflected power (or low VSWR) is often used as a figure of merit for coaxial components, including cables, connectors and cable assemblies. It is indicative of how well the uniformity of the cable is

Table 2
VSWR Conversions

VSWR (:1)	Return Loss (dB)	Reflection Coefficient	Mismatch Loss (dB)	Match Efficiency (%)
1.011	45	0.006	0.000	100.00
1.020	40	0.010	0.000	99.99
1.036	35	0.018	0.001	99.97
1.065	30	0.032	0.004	99.90
1.074	29	0.035	0.005	99.87
1.08	28	0.400	0.007	99.84
1.09	27	0.045	0.009	99.80
1.11	26	0.050	0.011	99.75
1.12	25	0.056	0.014	99.68
1.13	24	0.063	0.017	99.60
1.15	23	0.071	0.022	99.50
1.17	22	0.079	0.027	99.37
1.20	21	0.089	0.035	99.21
1.22	20	0.100	0.044	99.00
1.25	19	0.112	0.055	98.74
1.29	18	0.126	0.069	98.42
1.33	17	0.141	0.088	98.00
1.38	16	0.158	0.110	97.49
1.43	15	0.178	0.140	96.84
1.50	14	0.200	0.176	96.02
1.58	13	0.224	0.223	94.99
1.67	12	0.251	0.283	93.69
1.78	11	0.282	0.359	92.06
1.92	10	0.316	0.458	90.00
2.10	9	0.355	0.584	87.41
2.32	8	0.398	0.749	84.15
2.61	7	0.447	0.967	80.05
3.01	6	0.501	1.256	74.88
3.57	5	0.562	1.651	68.38
4.42	4	0.631	2.205	60.19
5.85	3	0.708	3.021	49.88

Match efficiency - e.g. 100 Watts Forward Power at 1.33:1 VSWR yields 98 Watts Output (i.e. 2 Watts Reflected)

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maintained along its length, whether the connectors are properly designed and attached and how well the transitions between line sizes are compensated for in the connectors. It is generally a function of frequency, with reflections generally getting higher as the frequency increases.

In many applications, low reflected power is critical for proper system performance. In these cases, it is essential that this be considered in the selection of the cable and connectors. In addition, care must be taken to properly attach the connectors to the cable in order to achieve the proper results. Purchase of completed, factory assembled and tested cable assemblies should be considered for VSWR critical applications.

Note that actual input impedance at a particular frequency may be quite different from the characteristic impedance of the cable due to reflections in the line. The Voltage Standing Wave Ratio (or VSWR) of a particular length of cable is an indicator of the difference between the actual input impedance of the cable and its average characteristic impedance.

Fig. 2
Attenuation Temperature Correction Factor

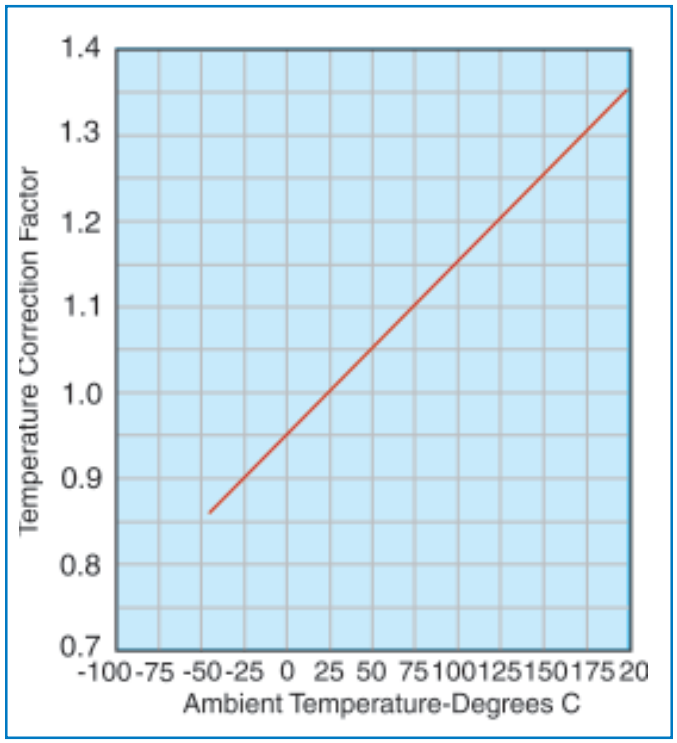
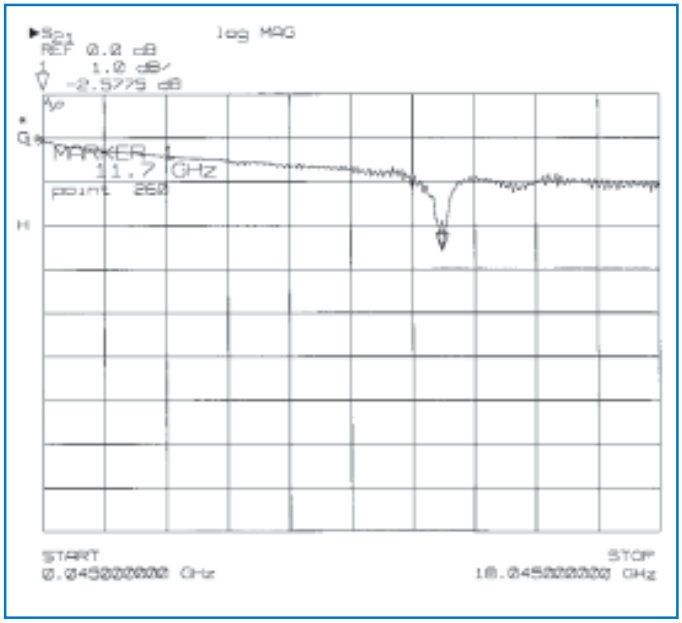


Fig. 3
Attenuation vs. Frequency



The impedance of long lengths of cable will exhibit very little change over their operating temperature ranges - less than 2%.

It is possible to fabricate cables having a characteristic impedance that varies through the length of the cable for matching purposes. Thus a coaxial cable can be used as a broadband impedance transformer to match differing source and load impedances. The transforming action is related to cable length and the minimum operating frequency, and the cable must be designed for the specific application.

C. ATTENUATION

Attenuation is the loss of signal along the length of a cable. As the RF signal passes through the cable, a portion of the signal is converted to heat and a portion of the signal leaks out of the cable through the outer conductor. This loss of signal is usually expressed in decibels per unit of length at a specific frequency, since attenuation increases with frequency.

For most applications, the objective is to minimize the losses in the cable runs or to stay within a loss budget. Minimum loss corresponds to an attenuation of 0 dB or a ratio of 1 to 1 between input and output power. Because cable losses decrease with increasing

cable diameter for the same type of construction, minimizing cable loss means maximizing cable size.

Attenuation is determined by the conductive and dielectric losses of the cable. Larger cables have lower conductor losses, reducing attenuation. Dielectric loss is independent of size. Dielectric losses increase linearly with frequency, while conductor losses increase with the square root of frequency. Therefore, dielectric losses become a larger proportion of the total cable loss as frequency increases.

Attenuation must be modified by a correction factor for the ambient temperature (see Figure 2). Elevated temperature increases cable attenuation by increasing the resistance of the conductors and by increasing the power factor of the dielectric (see Figure 6 for correction factors).

To select a cable construction for a particular application, determine the desired attenuation at the highest frequency from system requirements. Determine the corrected attenuation by dividing the desired attenuation by the temperature correction factor. Choose the smallest cable meeting the corrected attenuation value from the tables.

For cables with low attenuation for their size,see the LMR, StripFlex, SFT, and CLL families of cables.

Fig. 4
Attenuation vs. Flexure

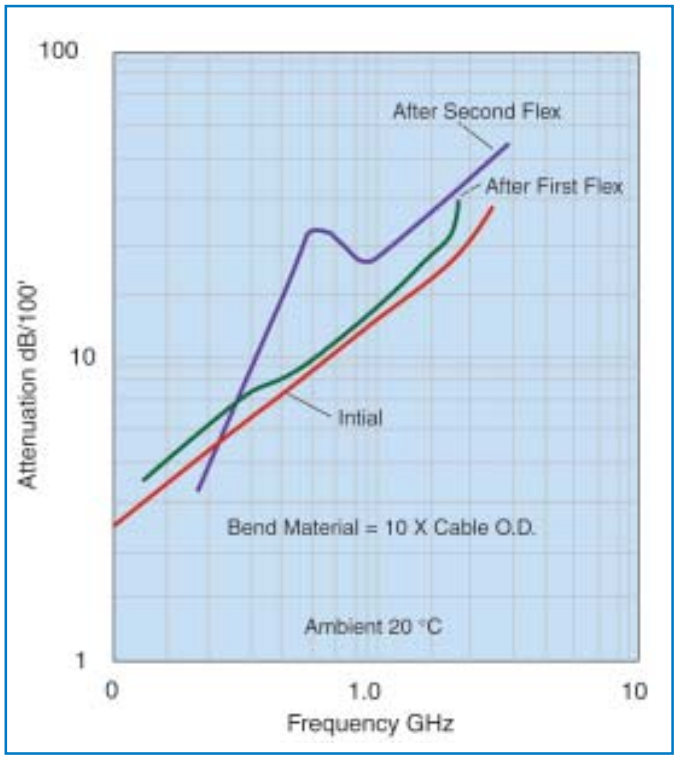
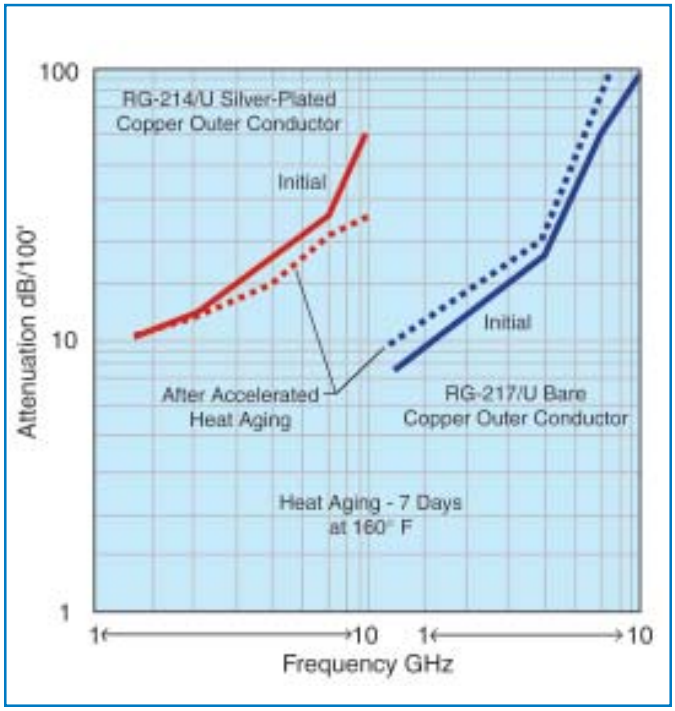


Fig. 5
Attenuation Stability



Attenuation Uniformity

The attenuation of any cable may not change uniformly as the frequency changes. Random and periodic impedance variations give rise to random and periodic attenuation responses. Narrow-band attenuation "spikes" such as that shown in Figure 3 can occur. If required, cables can be procured in various lengths where a maximum attenuation variation from nominal is specified over a customer defined frequency range.

Attenuation Stability

The attenuation of braided cables can increase with time and flexure. The change with time can be caused by corrosion of the braided shield, by contamination of the primary insulation due to jacket plasticizers, and by moisture penetration through the jacket. These

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effects can be essentially eliminated by encapsulating the braid with an appropriate flooding compound, as is done in the DB versions of the LMR cables. (Vapor penetration occurs at differing rates through all plastic and elastomeric materials.) Attenuation degradation is more pronounced at frequencies above 1 GHz. Cables having bare copper and tinned copper braids exhibit far greater attenuation degradation than cables with silver plated braids. These effects are illustrated in Figure 5.

The following guidelines apply:

a. Tin plated braids: Below 1 GHz, cables manufactured with tin plated braids have 15-20% more attenuation than bare copper braids in the "as manufactured" condition, but are more stable than bare copper braided cables.

b. Foam polyethylene: Flexible braided cables with foam polyethylene dielectrics have approximately 15 to 40% lower attenuation than solid polyethylene cables

Fig. 6
Power Temperature Correction Factor

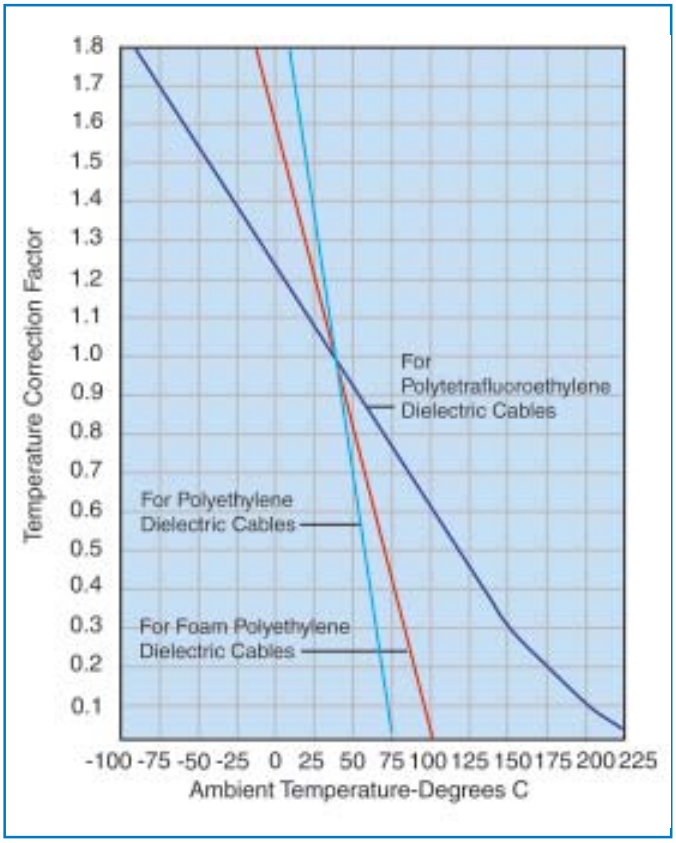
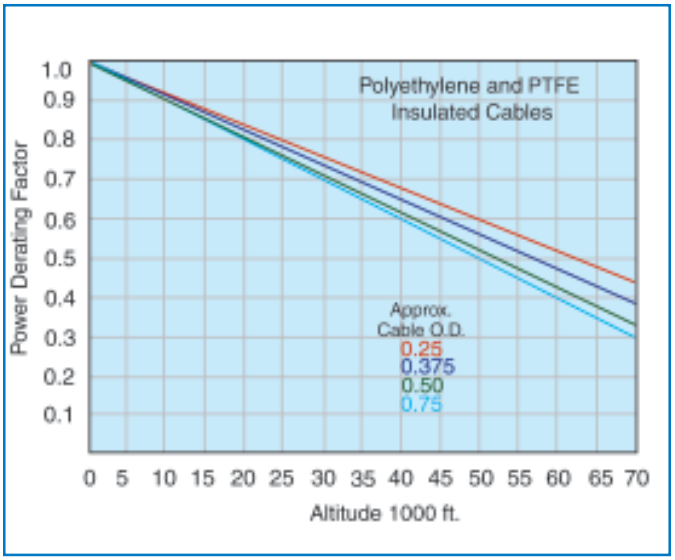


Fig. 7
Power Altitude Correction Factor



of the same core size and impedance. However, some polyethylene foams can absorb moisture causing attenuation increases. LMR cables utilize a closed cell, non-hydroscopic foam composition and are not subject to this problem.
See LMR cables.

c. If PVC jackets are used, a Type IIA, non-contaminating PVC should be specified for applications where attenuation uniformity over time is important. Type I PVC's contain plasticizers which can leach into the dielectric over time causing an increase in attenuation.

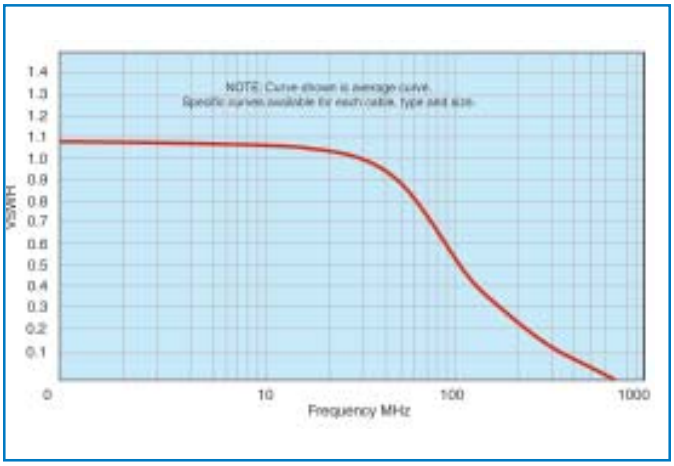
d. The ultimate in attenuation stability can be achieved by specifying hermetically-sealed cable assemblies. These will preclude the ingress of contaminants of any sort into the cable and result in the best stability, such as MilTech assemblies. Contact Times Microwave for more information on this type of assembly.

For flexible cables in extreme environmental conditions, a protected braid (e.g. LMR-DB) is recommended.

D. AVERAGE POWER RATING

Electrical losses in a coaxial cable result in the generation of heat in the center and outer conductors, as well as in the dielectric core. The power handling

Fig. 8
Second VSWR
Correction Factor Multiplier K



capability of a cable is related to the ability of the cable to dissipate this heat. The ultimate limiting factor in power handling is the maximum allowable operating temperature of the materials used in the cable, especially the dielectric. This is because most of the heat is generated at the center conductor of the cable. In general, the power handling capability of a given cable is inversely proportional to its attenuation, and directly related to its size. The other factor is the heat transfer properties of the cable, especially the dielectric.

Cable power ratings must be derated by correction factors for the ambient temperature, altitude and VSWR encountered in a particular application. High ambient temperature and high altitude reduce the power rating of a cable by impeding heat transfer out of the cable. VSWR reduces power rating by causing localized hot spots in the cable.

To select the cable construction for a particular requirement, determine the average input power at the highest frequency from system requirements. Then determine the effective average input power as follows:

$$\textbf{Effective Power} = \frac{\textbf{Average Power x (VSWR correction)}}{\textbf{(Temp. correction) x (Alt. correction)}}$$

Temperature and altitude corrections are shown on Figures 6 and 7.

VSWR correction factor =

$$\frac{1}{\textbf{1/2 (VSWR + VSWR) + 1/2 k1 (VSWR - VSWR)}}$$

Where k, is shown in Figure 8. Select a cable from the Attenuation and Power charts rated at this effective power level.

Note that the peak power handling capability of a cable is related to the maximum operating voltage rating. See Section E, below.

E. MAXIMUM OPERATING VOLTAGE

Care must be taken to ensure that the continuous voltage (and the peak voltage related to pulsed power conditions) applied to a cable is held below its maximum voltage rating. Note that there are two separate voltage ratings for a cable: Corona Voltage and Dielectric Withstanding Voltage:

1. Corona is a voltage related ionization phenomenon which causes noise generation, long term dielectric damage, and eventual breakdown of the cable. Thus, a cable cannot operate continuously with corona, and the maximum operating voltage must be less than the corona extinction level (extinction voltage) of the cable. The determination of corona voltages requires sensitive instrumentation capable of detecting the voltage induced ionization noise generation.

2. The Dielectric Withstanding Voltage, or dielectric strength of the cable, is a measure of the voltage level required to abruptly break down the dielectric employed in a cable. DWV testing requires less sensitive instrumentation, and is a test measurement where a voltage is applied to the cable for a limited time only, and monitored for current flow.

Maximum operating A.C. (RMS) voltage levels or peak voltage are given for each construction in the Cable Data Section of this catalog. The maximum permissible D.C. voltage level is conservatively 3 times the A.C. level.

To select a cable for a particular application, determine the actual RMS (peak /l.4) ,

$$\textbf{RMS voltage} = \frac{\textbf{(peak voltage value)}}{\textbf{1.4}}$$

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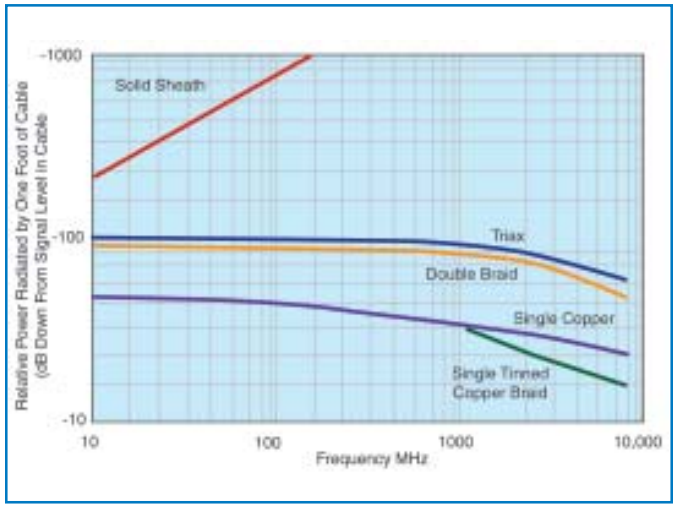
Fig. 9
Shielding Effectiveness



or actual peak voltage = (RMS x value 1.4)
from system requirements. Then determine the effective input voltage by multiplying the actual input voltage by the square root of the VSWR:

Effective voltage = Actual voltage x $(VSWR)^{1/2}$

Then select a cable with a maximum operating voltage greater than the effective RMS voltage. Maximum operating voltages are listed in the cable data section.

As the altitude where a cable is being used increases, the maximum operating voltage of a completed cable assembly is reduced due to the reduction in dielectric strength of the lower pressure air in the termination area.

F. SHIELDING AND CROSS-TALK (OR ISOLATION)

1. The shielding efficiency of a coaxial cable depends on the construction of its outer conductor. The most common constructions available are:

Single Braid: Consisting of bare, tinned, or silver plated round copper wires (70 to 95% coverage).

Double Braid: Consisting of two single braids as described above with no insulation between them.

Triaxial: Consisting of two single braids as described above with a layer of insulation between them.

Strip Braids: Consists of flat strips of copper rather than round wires (90% coverage).

Strip Outer Conductors/Spiral Flat Strips: Exhibiting @ 100% coverage.

Solid Sheath: Consisting of aluminum or copper tubing (100% coverage).

2. The relative shielding effectiveness of these constructions are illustrated in Figure 9 over the frequency range from 10 MHz to 8 GHz. This graph shows the level of signal which leaks through the outer shield of a one foot sample of each construction. The curves describing the performance of the flexible cables, i.e., the triax braid, double braid, and single braid construction are based on measured data.

To estimate the total leakage in cables under 1100 ft. long, add 20 log L to the figure read from the graph (where L is the cable length in feet). The curve showing the typical performance of the semi-flexible (or solid sheath) cables is based on theory. In practice the shielding efficiency of interconnections made using semi-flexible (solid sheath) cables is limited by the leakage at the connectors.

3. The isolation (or cross talk) between two coax cable runs is the sum of the isolation factors of the two cables and the isolation due to the "coupling factor" between the runs. This coupling factor will depend on the relative spacing, positioning and environment of the cable runs and on the grounding practices employed. The coupling factor will substantially affect the isolation between the cable runs.

4. Measurements show that the RF(1 -30 MHz) cross talk between two single braided coaxes over a 20 foot

Fig. 10
Phase Stability

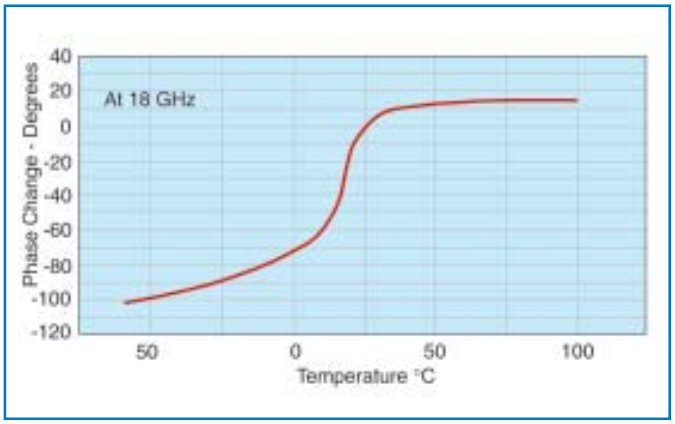
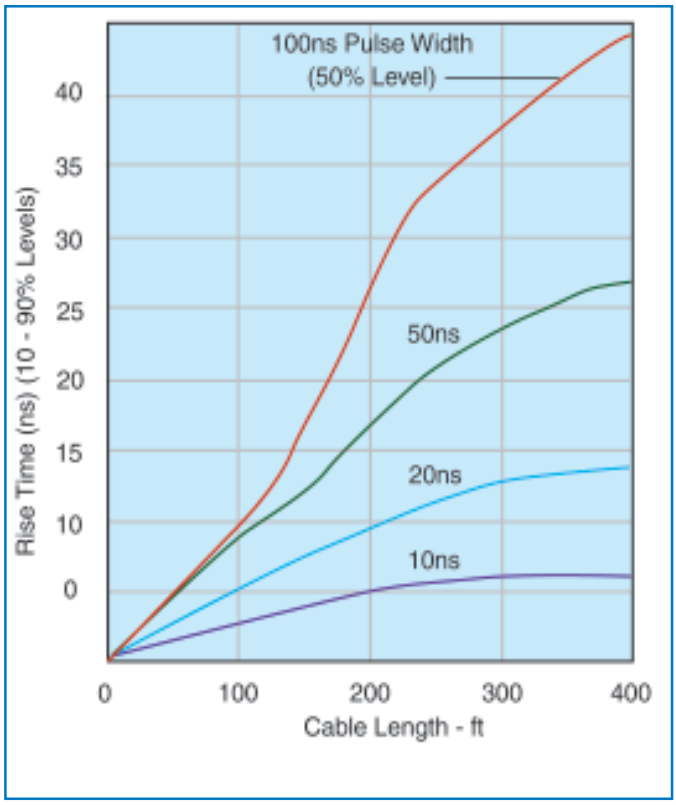


Fig. 11
Pulse Distortion



run length is approximately 80 db down from the signal level inside the cables. The coaxes were laid side-by-side over the 20 foot test length. (This test data illustrates the affect of the "coupling factor" noted above.)

5. Special Constructions that provide enhanced shielding characteristics are available. These cables include the LMR, RD, and RDT families of cables, and the StripFlex, SFT, and TFlex cables.

G. CAPACITANCE

Capacitance in a cable is related to the dielectric material and the characteristic impedance. Typical capacitance values are shown in the General Electrical Properties on page 187 for some common coaxial lines.

As seen in the table, the higher impedance cables provide lower "capacitance per foot" values, resulting in reduced loading for data communications applications.

H. VELOCITY OF PROPAGATION

The velocity of propagation in a coaxial cable is determined primarily by the dielectric constant of the insulating material between the inner and outer conductors. This property is usually expressed as a percentage of the velocity of light in free space, and is typically noted as Vg or Vp.

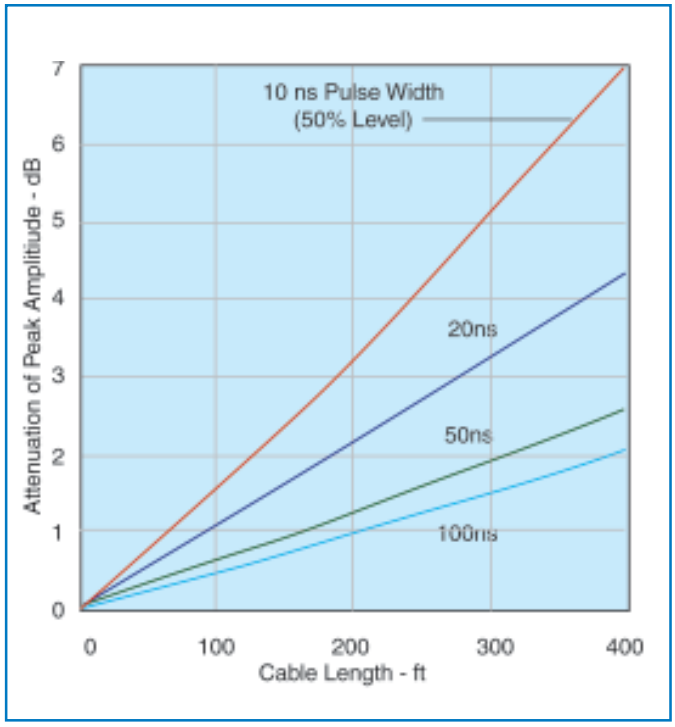
The General Electrical Properties on page 182 shows the velocity of propagation and time delay of cables insulated with commonly used dielectrics.

Delay lines made from coaxial cable can sometimes benefit from using lower velocity cables, thus providing maximum delay in the shortest length. But, the difference in loss between the lower and higher velocity cables must also be taken into account.

I. ELECTRICAL LENGTH STABILITY

Applications such as antenna feed systems may require many cable assemblies that are trimmed to a specific electrical length. In these applications, the change of the electrical length of the cable with temperature, flexure, tension and other environmental

Fig. 12
Pulse Amplitude vs. Length



factors is critical. The variation of electrical length with temperature for standard flexible cables is shown in Figure 10.

For polyethylene insulated cables:-100 to -250 parts per million/°C.

For TFE insulated cables:-50 to -100 parts/million/°C.

The variation of electrical length with temperature for the standard foam dielectric semiflexible cables is -20 to -30 parts/million/°C.

Times has special flexible and semiflexible cable designs with improved electrical length versus temperature characteristics. Semiflexible cables having an electrical length change with temperature as low as five parts/million per degree centigrade are available. See SFT and Coppersol Low Loss CLL cables.

J. CUT-OFF FREQUENCY

The cut-off frequency of a coaxial cable is that frequency at which modes of energy transmission other than the Tranverse Electro-Magnetic (TEM) mode can be generated. It does not mean that the TEM mode becomes highly attenuated. This frequency is a function of the mean diameter of the conductors and the velocity of propagation of the cable. The higher modes are only generated at impedance discontinuities and in many situations the cable can be operated above the cut-off frequency without substantial VSWR or insertion loss increase. However, it is recommended that cables not be operated above their cut-off frequency.

K. PULSE RESPONSE OF COAXIAL CABLES

1. The following characteristics must be considered when analyzing the Time Domain response of cable to pulses or step functions:

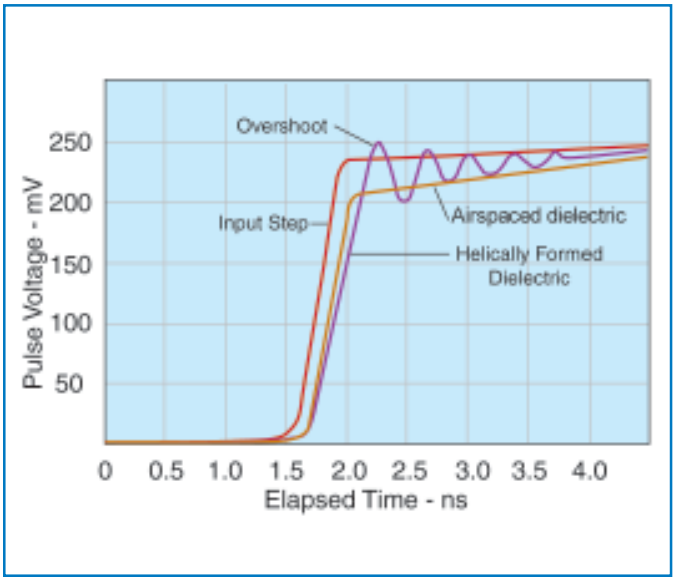
a: Impedance and Reflection;
b: Rise Time;
c: Amplitude;
d: Overshoot or Preshoot;
e: Pulse Echoes.

a: **Impedance and Reflection**

1. Select impedance to match system requirements.

2. The impedance will vary along the length of cable.

Fig. 13
Step Response
(Output Amplitude vs. Time)



Variations of +5% are not uncommon. Cables can be produced to tolerances of 2%. Tighter tolerances are not recommended.

b: & c: Rise Time and Amplitude

1. The output rise time is a function of input rise time, pulse width and cable attenuation. A typical pulse response is shown in Figures 11 and 12, while a typical step response is shown in Figure 13. Increased cable temperature causes an increase in rise time and decrease in amplitude.

d: Overshoot or Preshoot

1. Figure 13 shows the overshoot which can be encountered with a 0.1 ns input pulse rise time in cables due to finite reflections. Such overshoot is not common in cables with longitudinally extruded dielectrics.

2. Preshoot is encountered in some balanced delay lines and can be minimized by cable design.

e: Pulse Echoes

When a narrow pulse is placed on a cable, the distortions noted above will occur. In addition, a small pulse of energy may emerge after the initial pulse has arrived. This pulse echo is caused by finite periodic reflections within the cable. Normally the echo level can be neglected.

L. SELF-GENERATED CABLE NOISE

A noted cable phenomenon, is the generation of accoustical and electrical noise when flexed. The acoustical noise is a function of mechanical motion within the cable. Such noise (and the associated mechanical and frictional force) is minimized by proper cable design. Electrical noise generation is attributed to an electrostatic effect, which in testing has exhibited more than 500 millivolts in RG cable. This noise voltage can be minimized by preventing motion between dielectrics and conductors or dissipating electrostatic charges between conductors and dielectrics with semiconducting layers. Low noise constructions must take into account the life expectancy and environmental conditions to which they are subjected. Times manufactures low noise cables for special applications.

A noted cable phenomenon, is the generation of accoustical and electrical noise when flexed. The acoustical noise is a function of mechanical motion within the cable. Such noise (and the associated mechanical and frictional force) is minimized by proper cable design. Electrical noise generation is attributed to an electrostatic effect, which in testing has exhibited more than 500 millivolts in RG cable. This noise voltage can be minimized by preventing motion between dielectrics and conductors or dissipating electrostatic charges between conductors and dielectrics with semiconducting layers. Low noise constructions must take into account the life expectancy and environmental conditions to which they are subjected. Times manufactures low noise cables for special applications.

M. OPERATING TEMPERATURE RANGE

1. The operating temperature range of flexible coaxial cable is determined primarily by the operating temperature range of the dielectric and jacketing materials. Note that only silver plated conductors are suitable for long term use at temperatures over 80 degrees C.

2. Operating temperature limits of the most commonly used dielectrics and jacket types are given in the following table:

Material	Temperature Range
Polytetrafluoroethylene (PTFE)	-75°C to + 250°C
Polyethylene	-40°C to + 85°C
Foamed Polyethylene	- 40°C to + 100°C
Foamed or Solid Ethylene Propylene Jackets	- 40°C to + l05°C
Fluorinated Ethylene Propylene (FEP)	-70°C to +200°C
Polyvinylchloride (PVC)	- 40°C to + 85°C
Ethylene Chloro Trifluoroethylene (ECTFE)	- 65°C to + l50°C
Polyurethane	-100°C to + 125°C
Perfluoroalkoxy (PFA)	-65°C to + 260°C
Nylon	-60°C to + 120°C
Ethylene Propylene	- 40°C to + l05°C
High Molecular Weight Polyethylene	- 55°C to + 85°C
Crosslinked Polyolefin	- 30°C to + 85°C
Silicone Rubber	-70° to + 200°C
Silicone Impregnated Fiberglass	- 70°C to + 250°C
High Temperature Nylon Fiber	- 100°C to + 250°C

N. FLEXIBILITY

Coaxial cables with stranded center conductor and braided outer conductors are intended for use in those applications where the cable must flex repeatedly while in service. Cables with stranded center conductors will exhibit higher attenuation compared to cables with solid center conductors. In general, the higher the number of strands, the better the flexibility and the greater the increase in attenuation.

Standard braided outer conductor constructions will withstand over 1000 flexes through 180° if bent over a radius 20 times the diameter of the cable. Flexible cables may be stored, and are normally shipped, on reels with a hub radius greater than 10 times the

A guide to the selection of RF coaxial cable

diameter of the cable. If a flexible cable is to be installed in a fixed, bent configuration, the minimum bend radius recommended is 5 times the cable diameter. Tighter bends can be made. Special braid designs are available for improved flex-life.

Coaxial cables with a tubular aluminum or copper outer conductors, commonly referred to as semi-flexible or semi-rigid cables, will not withstand more than ten 180- bends over a bend radius equal to 20 times the diameter of the cable. Semi-flex cables are normally shipped on reels having a hub radius of 20 times the O.D. of the cable. Semi-flex cables may be field bent for installation. The minimum recommended bend radius is equal to 10 times the O.D. of the cable. Cables bent on a bend radius of 5 times the O.D. of the cable may exhibit mechanical and electrical degradation.

O. ENVIRONMENTAL RESISTANCE

The life of a coaxial cable depends on many factors. The effects of ultra-violet exposure, high humidity, galvanic action, salt-water and corrosive vapors on the materials used are prime causes of cable failure. Resistance to flame must also be considered. The following guidelines apply:

a. Sunlight: For low temperature cables exposed to sunlight (ultra-violet), the use of high molecular weight polyethylene, with a specific carbon black particle size, % by weight and particle distribution, is recommended for maximum life expectancy. Polyvinylchloride jackets exhibit a life expectancy of less than 1/2 that of properly compounded polyethylene.

b. Humidity or water vapor can enter flexible cables through pin-holes in the jacket, at the connector, or by vapor transmission through the jacket. All materials exhibit a finite vapor transmission rate. For example, a ten foot length of cable with a polymer outer jacket exhibits a helium leak rate of approximately 10^{-4} cc/sec/ft. Even the least porous thermoplastics, such as FEP, do not offer a significant improvement. In airborne applications, the combination of finite vapor transmission rates and large temperature extremes cause condensation in cables. The moisture can collect in low areas causing corrosion or shorting of a connector. One method of preventing moisture accumulation in cables is to fill all voids with a moisture-proofing compound which will not harden with age. See LMR-DB and Imperveon Cables for additional data. Times also supplies hermetically sealed cable assemblies with leak rates of less than 10^{-5} cc/sec/ft.

c. Salt-water Immersion-The electrical characteristics of cable will be rapidly affected if the conductors are exposed to salt-water. Unless an immersion test is performed on the jacket, there is a good possibility of one pinhole per 1000 feet. Even if sufficient tests could be performed, damage during installation or damage from rodents normally will cause leakage. Pressure-tight, non-hosing cables capable of withstanding the pressure at the required cable depth can be recommended.

d. Corrosive Vapors: The use of tin and silver coatings does afford some protection against corrosive vapors. However, such protection is short-lived. For installation near salt-water or chemical plants, a filled cable such as LMR-DB or Imperveon is recommended.

e. Underground Burial & Galvanic Action: Underground moisture which comes in contact with any cable metals, will cause rapid corrosion. Tubular aluminum outer conductors have been almost destroyed in 90 days. Therefore, any cables installed underground should have pinhole-free jackets. Since jacket damage due to installation techniques and rodents can occur, cables filled with a flooding compound should be used. For maximum reliability against rodents, a steel tape armor with over-jacketing is recommended.

f. Flame Resistance: Cables have different degrees of flame re break strength of the outer conductor, if the center conductor will stretch up to 10% before breakage. Caution must be taken with cables with copper-covered steel or alloy center conductors where breakage would occur with only 1 to 10% elongation. Conductor sizes less than 26 AWG can easily be broken during assembly operations. Special alloy conductors are available which can achieve a tensile strength of 110,000 psi and 10% elongation.

P. CABLE STRENGTH

The break strength of the cable depends primarily on the strength of the outer conductor. The cables will normally achieve at least 70% of the break strength of the outer conductor, if the center conductor will stretch up to 10% before breakage. Cautin must be taken with cables with copper-covered steel or alloy center conductors where breakage would occur with only 1% to 10% elongation. Conductor sizes less than 26 AWG can easily be broken during assembly operations. Special alloy conductors are available which can achieve a tensile strength of 110,000 psi and 10% elongation.

Q. QUALIFICATION APPROVAL

Often, cables must be qualified to certain standards to allow usage in particular applications. Typical examples of necessary qualifications are:

Military: Most military applications require that cable conform to particular specifications. Many of these specifications require the manufacturer to qualify product by conducting a series of tests on a length of cable with a military representative present as a witness. MIL-C-17, the basic specification for most coaxial cables, requires a Qualified Products List (QPL). TMS maintains numerous MIL-C-17 qualifications.

Commercial (UL) Approval: The building codes of many cities require that cables installed in their buildings be approved by the Underwriters Laboratories (UL). With UL service, the cable is subjected to a clearly defined series of tests and examinations, and has met the quality and safety standards imposed by Underwriters Laboratories. Approval of new designs meeting UL standards normally can be made in a relatively short period of time. A large variety of TMS products are UL approved.

New York State Requirements: Article 15, Part 1120 of the New York State Uniform Fire Prevention and Building Code requires that materials used in some buildings and transit systems be tested and registered with The New York Department of State. For theTMS products tested, the fire/gas/toxicity data is found in: DOS file number 16120-931203-4001.

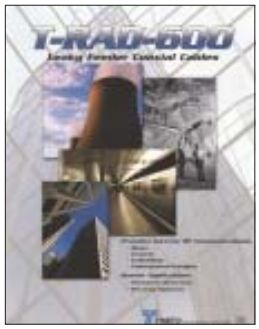
London Underground Limited: TMS has gained LUL approval on a series of low-smoke cable constructions. These cables were tested for smoke emission, toxic fume emission, and flammability assessment against the requirements of the London Underground Code of Practice for fire safety.

Contact your TMS representative for more information regarding TMS product qualifications.

MSHA Approvals: TMS has qualified the complete range of LMR-FR coaxial cables and T-RAD-FR leaky feeder cables to the MSHA flame requirements. Contact your TMS representative for further information.

TIMES MICROWAVE SYSTEMS

Other catalogs available from Times Microwave



T-RAD®-600 Leaky Feeder Coaxial Cables

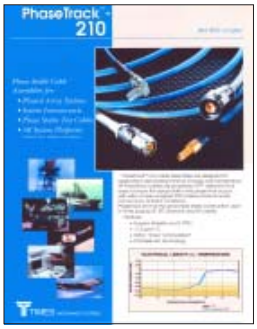
Radiating cables for cost effective RF coverage in enclosed or underground areas such as metro stations, tunnels, mines, ships and in-building wireless systems.

PhaseTrack™ 230R Test Cables with Replaceable Connectors

Thermally phase stable cable assemblies for phased arrays, test cables and systems platforms.

Coaxial Cable Assemblies, Products & Capabilities

High performance microwave cable assemblies for military electronic warfare systems, commercial aircraft, shipboard and ground based communications systems.

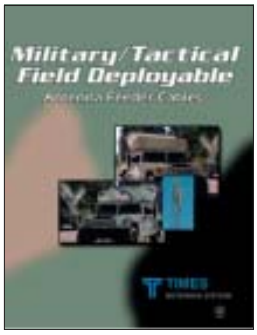


PhaseTrack™ 210 Test Cables & Connectors

Thermally stable test cables with removable, interchangeable connectors that experience the lowest phase change with temperature fluctuations.

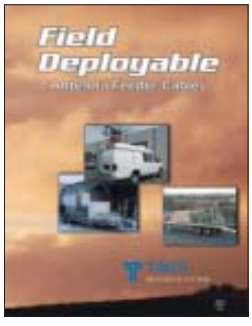
High Power RF Cables & Assemblies

Broad range of high power coax cables and assemblies for medical (MRI), semiconductor manufacturing equipment, lasers, particle physics experimentation and industrial applications.



Tactical Field Deployable Antenna Cables

T-Com®, QEAM™, and LLSB™ cables suitable for the harshest mobile, portable or temporary military field deployed antenna applications.

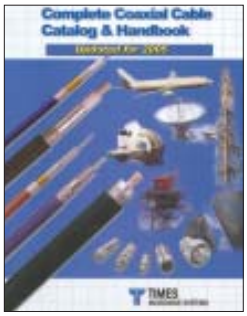


Field Deployable Antenna Feeder Cables

LMR®, T-Com® and QEAM™ cables are suited for the rigors of any mobile, portable or temporary field antenna deployment.

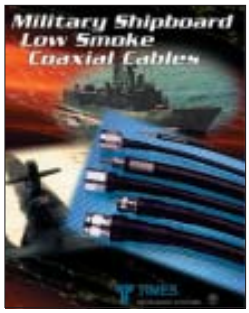
Broadband Wireless Cable Assemblies

Purchasing and technical information for 50 ohm coaxial cables assemblies and jumpers-licensed and unlicensed bands.



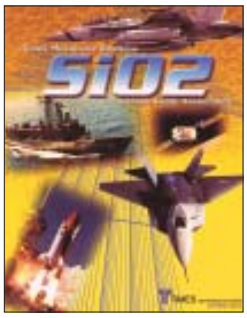
Coaxial Cable Catalog & Handbook

High performance RG, Mil-C-17, LSSB®, Stripflex®, T-Com®, and Tflex® coax cable.



Shipboard Low Smoke Coaxial Cables

Low-loss, low smoke coaxial cables for military and commercial shipboard applications.



SiO2 Silicon Dioxide Coaxial Cable Assemblies

Crack-free, low loss glass dielectric and laser welded technology combine to provide unequaled low VSWR and hermetic sealing performance.

Blind Mate Antenna Applications

Unique interconnect systems for quick avionics and electronic warfare system antenna connect/ disconnect.

Silverline™ TuffGrip™ Test Cables

For wireless system testing, make connections with just one wrench!

SFT™ Coax Connectors & Assemblies

Professional grade test cables and adapters for testing portable and mobile radios.

Silverline™ QMA Test Cables

Professional grade test cables and adapters for testing portable and mobile radios

Heli-Foil™ Coax Ultra Low Loss Cables & Connectors

18 GHz ultra low loss bulk coaxial cable and connectors for self assembly.

TIMES MICROWAVE SYSTEMS

Attenuation (dB per 100 feet ; +25C)

	2 1/4" LDF	1 5/8" LDF	1 1/4" LDF	LMR-1700	7/8" LDF	LMR-1200	LMR-900	1/2" LDF	LMR-600	LMR-500	1/2" SuperFlex	3/8" LDF
Frequency / Size	2.350"	1.980"	1.550"	**1.670"**	1.090"	**1.200"**	**0.870"**	0.630"	**0.590"**	**0.500"**	0.520"	0.440"
30 MHz	0.096*	0.120	0.147	**0.149**	0.197	**0.209**	**0.288**	0.369	**0.421**	**0.54**	0.561	0.567
50 MHz	0.125*	0.156	0.191	**0.195**	0.257	**0.272**	**0.374**	0.479	**0.547**	**0.70**	0.730	0.736
150 MHz	0.227*	0.280	0.340	**0.347**	0.458	**0.481**	**0.658**	0.845	**0.964**	**1.22**	1.29	1.30
220 MHz	0.281*	0.345*	0.416*	**0.427**	0.560*	**0.589**	**0.803**	1.05*	**1.18**	**1.49**	1.58*	1.59*
450 MHz	0.422	0.515	0.617	**0.632**	0.834	**0.864**	**1.17**	1.51	**1.72**	**2.17**	2.32	2.30
700 MHz	-.-	-.-	-.-	**0.809**	-.-	**1.10**	**1.48**	-.-	**2.18**	**2.77**	-.-	-.-
900 MHz	0.641*	0.767*	0.912*	**0.936**	1.23*	**1.27**	**1.70**	2.21*	**2.50**	**3.13**	3.41*	3.36*
1,500 MHz	0.879*	1.050	1.22	**1.26**	1.66	**1.69**	**2.24**	2.93	**3.31**	**4.13**	4.57	4.43
2,000 MHz	1.058*	1.250	1.45	**1.50**	1.97	**1.99**	**2.63**	3.45	**3.90**	**4.84**	5.41	5.21
2,500 MHz	-.-	1.440	1.68*	**1.71**	2.27*	**2.26**	**2.98**	3.91*	**4.42**	**5.48**	6.17*	5.91*
Attenuation at Any Frequency = [k1 x SqRt (Fmhz)] + [k2 x Fmhz] or use Performance Calculator at www.timesmicrowave.com												
k1				**0.02646**		**0.03737**	**0.05177**		**0.07555**	**0.09659**		
k2				**0.00016**		**0.00016**	**0.00016**		**0.00026**	**0.00026**		

Power Handling (kW ; +40C ; Sea Level)

	2 1/4" LDF	1 5/8" LDF	1 1/4" LDF	LMR-1700	7/8" LDF	LMR-1200	LMR-900	1/2" LDF	LMR-600	LMR-500	1/2" SuperFlex	3/8" LDF
Frequency / Size	2.350"	1.980"	1.550"	**1.670"**	1.090"	**1.200"**	**0.870"**	0.630"	**0.590"**	**0.500"**	0.520"	0.440"
30 MHz	39.5*	28.9	21.1	**20.3**	14.0	**12.6**	**8.9**	6.31	**5.5**	**4.4**	5.75	4.14
50 MHz	30.2*	22.1	16.2	**15.6**	10.7	**9.7**	**6.8**	4.85	**4.3**	**3.4**	4.42	3.19
150 MHz	16.7*	12.3	9.09	**8.7**	6.04	**5.5**	**3.9**	2.75	**2.4**	**1.9**	2.49	1.81
220 MHz	13.5*	13.5*	7.45*	**7.1**	4.94*	**4.5**	**3.2**	2.23*	**1.9**	**1.6**	2.04*	1.49*
450 MHz	8.91	6.71	5.01	**4.8**	3.32	**3.1**	**2.2**	1.53	**1.3**	**1.1**	1.38	1.02
700 MHz	-.-	-.-	-.-	**3.8**	-.-	**2.4**	**1.7**	-.-	**1.1**	**0.85**	-.-	-.-
900 MHz	5.90*	4.49*	3.39*	**3.3**	2.24	**2.1**	**1.5**	1.05*	**0.93**	**0.75**	0.944*	0.703*
1,500 MHz	4.29*	3.30	2.52	**2.4**	1.66	**1.6**	**1.1**	0.793	**0.70**	**0.57**	0.705	0.530
2,000 MHz	3.57*	2.76	2.13	**2.0**	1.40	**1.3**	**1.0**	0.673	**0.59**	**0.49**	0.597	0.451
2,500 MHz	-.-	2.40	1.84*	**1.8**	1.21*	**1.2**	**0.9**	0.594*	**0.52**	**0.43**	0.547*	0.398*

General Performance Properties

	LMR-1700	LMR-1200	LMR-900	LMR-600	LMR-500	LMR-400	LMR-300	LMR-240	LMR-200
Conductor: (note 1)	0.527"	0.349"	0.262"	0.176"	0.142"	0.109"	0.070"	0.056"	0.044"
Dielectric: Cellular PE (note 2)	1.350"	0.920"	0.680"	0.455"	0.370"	0.285"	0.190"	0.150"	0.116"
Shield: Aluminum Tape (note 3)	1.356"	0.926"	0.686"	0.461"	0.376"	0.291"	0.196"	0.155"	0.121"
Tinned Copper Braid	1.402"	0.972"	0.732"	0.490"	0.405"	0.320"	0.225"	0.178"	0.144"
Jacket: Black PE (note 4)	1.670"	1.200"	0.870"	0.590"	0.500"	0.405"	0.300"	0.240"	0.195"
Bend Radius (note 5)	13.5"	6.5"	3"	1.5"	1.25"	1"	.875"	0.75"	0.50"
Weight(lbs/foot)	0.736	0.448	0.266	0.131	0.097	0.068	0.055	0.034	0.022
Temperature Range	-40°C to +85°C								
Impedance	50 Ohms								
Velocity (%)	89	88	87	87	86	85	85	84	83
Capacitance (pF per Foot)	22.8	23.1	23.4	23.4	23.6	23.9	24.1	24.2	24.5
DC Resistance: center conductor	0.21	0.32	0.54	0.53	0.82	1.39	2.12	3.20	5.36
(ohms/1000') : shield	0.27	0.37	0.55	1.20	1.27	1.65	2.21	3.89	4.90
Shielding	> 90 db								

Selection Guide

TIMES MICROWAVE SYSTEMS

LMR-400	3/8" SuperFlex	Belden 9913	ULTRA-LINK™	RG213/ RG214	1/4" SuperFlex	LMR-300	LMR-240	Belden RG8X	LMR-200	ULTRA-LINK	LMR-195	RG-58	LMR-100A
0.405"	0.415"	0.405"	0.405"	0.405"	0.300"	0.300"	0.240"	0.242"	0.195"	0.195"	0.195"	0.195"	0.110"
0.7	0.654	0.8	0.7	1.2	0.98	1.1	1.3	2.0	1.8	2.5	2.0	2.5	3.9
0.9	0.848	0.9	-.-	1.6	1.27	1.4	1.7	2.5	2.3	-.-	2.6	3.1	5.1
1.5	1.49	1.6	1.5	2.8	2.23	2.4	3.0	4.7	4.0	5.1	4.4	6.2	8.9
1.8	1.82*	-.-	-.-	3.5	2.72	2.9	3.7	6.0	4.8	-.-	5.4	7.4	10.9
2.7	2.66	2.8	2.7	5.2	3.93	4.2	5.3	8.6	7.0	9.5	7.8	10.6	15.8
3.42	-.-	-.-	-.-	-.-	-.-	5.1	6.6	-.-	8.7	-.-	9.8	-.-	20.0
3.9	3.86*	4.2	4.19	8.0	5.67*	6.1	7.6	12.8	9.9	14.0	11.1	16.5	22.8
5.1	5.12	5.6	-.-	-.-	7.47	7.9	9.9	-.-	12.9	-.-	14.5	-.-	30.0
6.0	6.01	6.7	-.-	-.-	8.73	9.2	11.5	-.-	15.0	-.-	16.9	-.-	35.0
6.8	6.84*	-.-	6.8*	-.-	9.85*	10.4	12.9	-.-	16.9	37*	19.0	-.-	40.0
0.12229						0.19193	0.24208		0.32090		0.35686		0.70914
0.00026						0.00033	0.00033		0.00033		0.00047		0.00174

LMR-400	3/8" SuperFlex	Belden 9913	ULTRA-LINK	RG213/ RG214	1/4" SuperFlex	LMR-300	LMR-240	Belden RG8X	LMR-200	ULTRA-LINK	LMR-195	RG-58	LMR-100A
0.405"	0.415"	0.405"	0.405"	0.405"	0.300"	0.300"	0.240"	0.242"	0.195"	0.195"	0.195"	0.195"	0.110"
3.3	3.97	2.2	-.-	1.8	2.28	2.1	1.49	0.35	1.02	4.0	0.89	0.40	0.23
2.6	3.06	1.7	-.-	1.2	1.76	1.6	1.15	0.28	0.79	-.-	0.68	0.30	0.18
1.5	1.74	0.90	-.-	0.62	1.00	0.93	0.66	0.15	0.45	2.0	0.39	0.16	0.10
1.2	1.44*	-.-	-.-	-.-	0.825*	0.76	0.54	-.-	0.37	-.-	0.32	-.-	0.08
0.83	0.975	0.45	-.-	0.30	0.567	0.52	0.38	0.08	0.26	1.0	0.22	0.08	0.06
0.66	-.-	-.-	-.-	-.-	-.-	0.43	0.30	-.-	0.21	-.-	0.18	-.-	0.05
0.58	0.674*	0.28	-.-	0.18	0.393*	0.36	0.26	0.05	0.18	0.65	0.15	0.05	0.040
0.44	0.507	0.20	-.-	-.-	0.299	0.28	0.20	-.-	0.14	-.-	0.12	-.-	0.030
0.37	0.431	0.16	-.-	-.-	0.256	0.24	0.17	-.-	0.12	-.-	0.10	-.-	0.025
0.33	0.379*	-.-	-.-	-.-	0.225*	0.21	0.15	-.-	0.10	-.-	0.09	-.-	0.020

Competitor's Data As Published
*=estimated from published data.

LMR-195	LMR-100A
0.037"	0.018"
0.113"	0.060"
0.118"	0.065"
0.141"	0.083"
0.195"	0.110"
0.50"	0.25"
0.022	0.009
80	66
24.3	30.8
7.58	81.0
4.90	9.5

NOTES:

(1) Center Conductor in LMR-900, LMR-1200 & LMR-1700 is Copper Tube
Center Conductor in LMR-400, LMR-500 & LMR-600 is Copper Clad Aluminum
Center Conductor in LMR-195, LMR-200, LMR-240 and LMR-300 is Bare Copper
LMR-100A is BCCS

(2) Low loss closed cell polyethylene foam (LMR-100A solid polyethylene)

(3) Aluminum laminated tape bonded (LMR-100A unbonded) to the Dielectric with a Tinned Copper Overbraid

(4) Black UV protected polyethylene (LMR-100A black PVC)

(5) Less than 1 ohm impedance change at bend

TIMES MICROWAVE SYSTEMS

Part Reference Guide

TIMES MICROWAVE SYSTEMS

Part Reference Guide

MISSION

TIMES MICROWAVE SYSTEMS designs and manufactures high performance RF transmission line for the telecommunications industry.

These products consist of flexible coaxial cable, 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.

TIMES *MICROWAVE SYSTEMS*

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