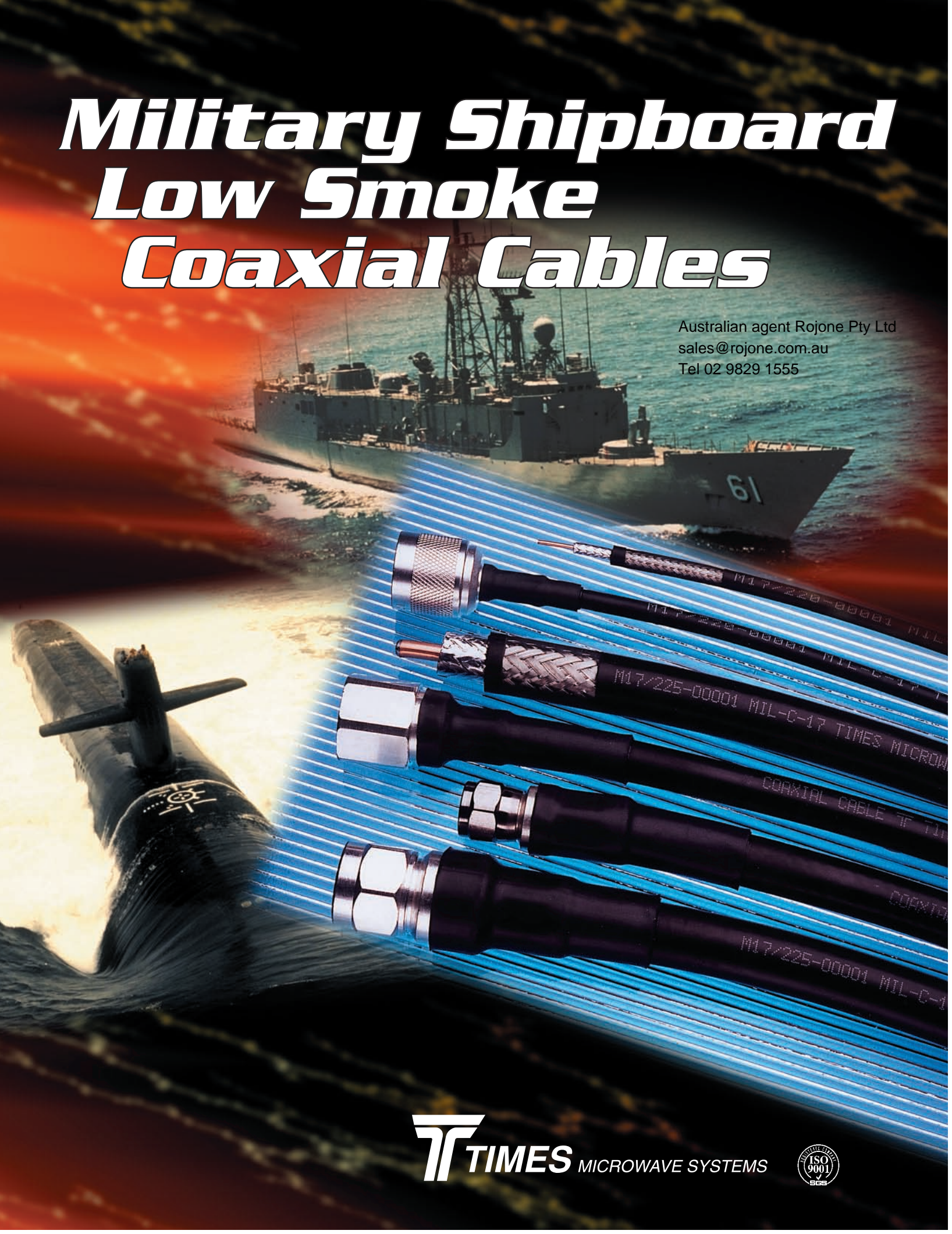


# ***Military Shipboard Low Smoke Coaxial Cables***

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**T** **TIMES** MICROWAVE SYSTEMS



# INTRODUCTION



Times Microwave Systems, designs and manufactures high performance coaxial cables, connectors and cable assemblies for a broad range of RF transmission applications. For more than 50 years, Times has been the leader in the development of new cable technologies to meet the demands of evolving RF and microwave applications. This technological, manufacturing and application leadership continues today.

Since its inception, Times has been dedicated to the improvement of coaxial cable technology and the development of new and innovative cable products to address the increasingly rigorous demands placed on RF transmission products.

The expertise that has provided cable solutions for the demanding requirements of airborne electronic warfare systems has led the way in the development of low smoke cables for shipboard, airborne and ground based military interconnect systems.

Times 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 more QPL's (Qualified Product Listings) than any other manufacturer in the world.

Times 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 Times is to select or design the right product for each application.

This catalog serves as a guide to the qualified military low-smoke, non-halogen RF cables available from Times Microwave Systems.

# Low-Smoke, Non-Halogen Coaxial Cables

## Military Shipboard Qualifications

Since the 1940's, MIL-C-17 has been the definitive specification for coaxial, triaxial and other high performance radio frequency cables. Beginning in 1970, United States standards making organizations have been establishing safety requirements for product flame retardance, and more recently, smoke, toxicity and corrosive off-gassing properties. With revision "G", MIL-C-17 adapts qualification tests for each of these characteristics, which assures the coaxial cable you select for your applications will meet the minimum safety standards.

In 1993, per MIL-STD-454, the military began the process of inactivating the use of polyvinylchloride (PVC) radio frequency cables, that were used in military weapons' systems. A new series of cross-linked, low-smoke, non-halogen coaxial cables were qualified to replace the older inactivated PVC versions.

Many of the requirements existent in the MIL-C-24640 and MIL-C-24643 multi-conductor, low-smoke shipboard cables specifications were incorporated into revision "G" of MIL-C-17. Table I describes some of these added requirements as well as typical testing results.

In addition to the products of combustion requirements, these cross-linked, low-smoke designs offer higher levels of abrasion and fluid resistance, that are commonly required in many of today's naval shipboard environments.

## Attenuation and Structural Return Loss

MIL-C-17 specifications require that attenuation and structural return loss (VSWR) be completely tested by sweeping 22 different 50 ohm cables over the frequency band for which their use is recommended. Variance in materials or in the manufacturing process can cause periodic discontinuities along a length of coaxial cable, which can introduce resonance peaks (spikes). These spikes occur when the discontinuities or changes in electrical characteristics are periodic and at half-wave distances.

When impedance changes occur periodically, there are frequencies in which all of the reflections are in phase, resulting in a large reflected signal or VSWR of the cables and their connectors. Periodic reflections can also cause substantial increase in attenuation at the resonance peaks. In the past, it was very unusual to detect these narrow band, high attenuation spikes, when cables were tested for attenuation using the older MIL-C-17D discrete frequency test procedure (generally at 400 MHz and 3 GHz and also at 10 GHz for RG-214).

Now, however, M17/190-RG214 has continuous swept maximum VSWR and attenuation requirements from 50 MHz to 11 GHz. The maximum VSWR is 1.15:1 (23 dB SRL) at 100 MHz increasing to 60 dB/100 feet at 11 GHz.

Coaxial cables that do not require "full band" swept frequency performance can be procured under separate part numbers in an unswept version. The specifications sheets for these unswept cables recommend that they not be used above 400 MHz. The user must decide which cables will best suit the situation based on cost, application and potential for system growth and improvement.

## MIL-C-17 QPL Listing

Only qualified cables should be used for military contracts. All manufacturers of MIL-C-17 cables must obtain qualification approval for their cables. The qualified products are then listed in QPL-17, which is updated periodically throughout the year. Please note that all RG numbered cables have been cancelled from MIL-C-17 and only cables with part numbers starting "MIL/17" should be used for new military contracts. Since

there is no longer any control of "RG" specifications, many cables on the market with RG designations may be completely different in construction and performance.

## Special Designs

Although MIL-C-17 covers a broad range of cable types, Times can also provide technical assistance in designing specialized shipboard cables to meet specific system parameters that cannot be met with existing MIL-C-17 cables. Please contact our Engineering Department for assistance with your specialized applications.



Qualification Inspections Critical to MIL-C-17(G)	MIL-C-17 Requirements	Typical MIL-C-17(G) Inspection Results
Flame Propagation (IEEE-383)	8 Foot Maximum Burn	Pass
Acid Gas Generation	2.0 Maximum	0.20
Halogen Content	.20 Maximum	0.06%
Smoke Index (NES 711)	25.0 Maximum	11.4
Toxicity Index (NES 713)	5.0 Maximum	<2.2
Weathering	75% Minimum Retention	Pass
Abrasion Resistance	75 Cycles Minimum	175 Cycles
Tensile Strength	1300 psi Minimum	1800 psi
Elongation	160% Minimum	200%
Fluid Resistance	50% Minimum Retention	Pass
Heat Distortion	30% Maximum	10%

Table 1: MIL-C-17 shipboard cable requirements

# LSRG Military Shipboard Coax

## MIL-C-17 Qualified

- MIL-Spec Air Frame, Shipboard, Ground (Tactical) Interconnect (M17/180–/200)
- Fire Retardant / Low Smoke (non-halogen)
- Flexible For Easy Deployment / Routing



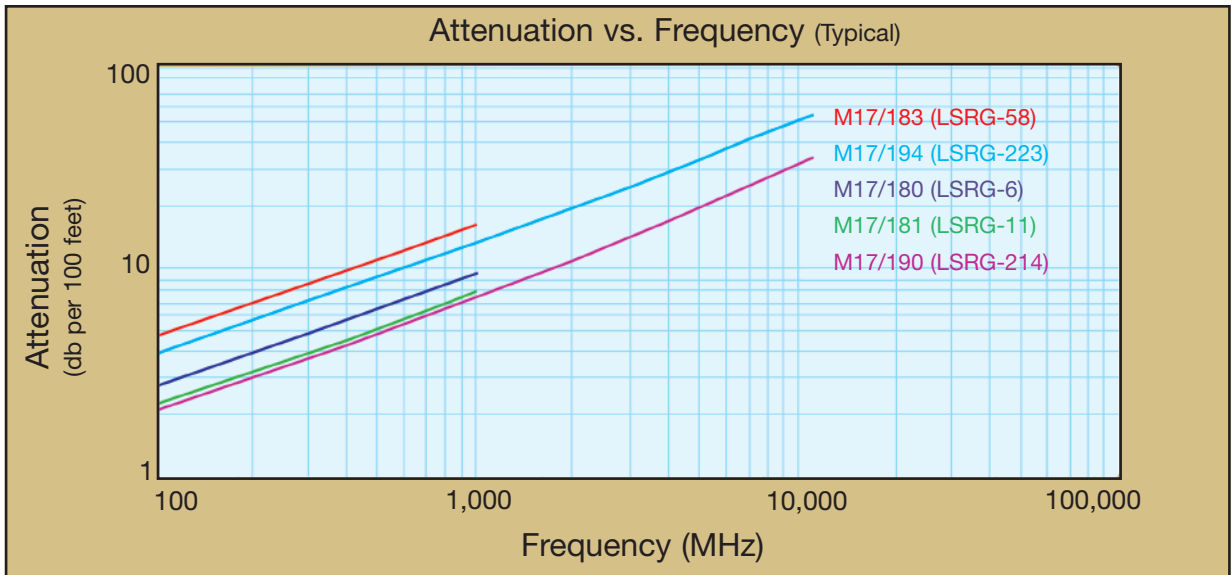
### Features & Benefits

- Rugged Abrasion Resistant Jacket
- Excellent Shielding Effectiveness
- Fire Retardant (non-halogen)
- Light Weight
- Flexible for Ease of Deployment
- Excellent Connector Selection

- **Flexible:** With very tight minimum bend radius, LSRG cable can be easily routed into and through tight spaces. Ideal for tactical deployment and retrieval.
- **Excellent Loss:** LSRG has lower loss than other cables of the same size and is significantly less than the M17 spec requirement.
- **Fire Retardant:** A black UV resistant non-halogen, low smoke - fire retardant, cross-linked polyethylene jacket makes the cable rugged and resistant to the full range of military/defense environments. LSRG cables easily achieve FAR 25, NES-711 and NES-713 compliance.
- **RF Shielding:** High coverage (>95%) braids, result in >40-60 dB RF shielding (>80 dB - 120 dB crosstalk) and excellent interference immunity (ingress and egress).
- **Connectors and Assemblies:** A full range of connector interfaces is available in crimp or clamp styles. Custom pre-terminated and tested assemblies with phase matching, insertion loss matching, and other special electrical or marking requirements can also be provided.
- **Reference:** See page 8 for complete listing of qualified M17/180-/200 shipboard cable constructions.

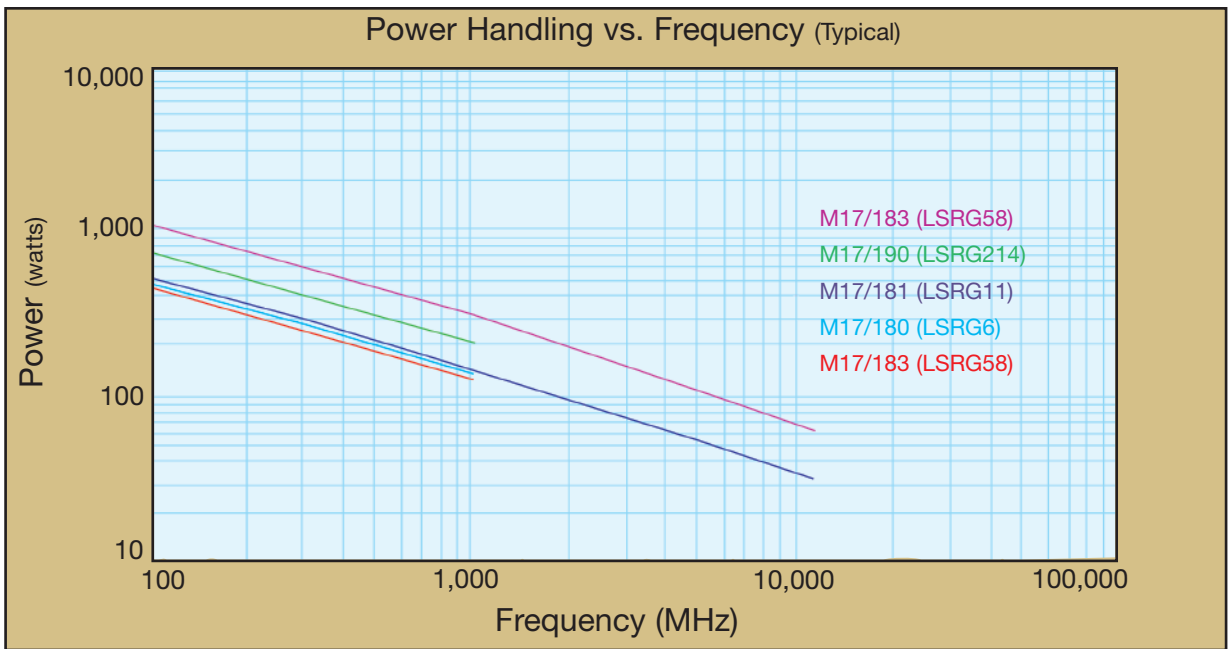
TMS M17 No.	M17 QPL No.	TMS Dwg No.	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Weight lbs/ft (kg/m)	Impedance (ohms) Vp (%)	Capacitance pF/ft (pF/m)	Max. Op Voltage vms	Temp. Range F (C)	M17 Test Frequency (max)
LS-RG6 M17/180-00001	17-05-92	AA-7276	CCS 0.0285 (0.72)	PE 0.185 (4.70)	34 SC:34 BC 0.243 (6.17)	XLPE 0.332 (8.43)	0.092 (0.137)	75 +/- 3 65.9	20.6 (67.6)	2,700	-22 +185 (-30 +85)	3 GHz UnSwept
LS-RG11 M17/181-00001	17-05-92	AA-7277	TC 7/.0159 0.0477 (1.21)	PE 0.285 (7.24)	33 BC 0.318 (8.08)	XLPE 0.405 (10.29)	0.142 (0.212)	75 +/- 3 65.9	20.6 (67.6)	5,000	-22 +185 (-30 +85)	3 GHz UnSwept
LS-RG58 M17/183-00001	17-05-92	AA-7281	TC 19/.0072 0.108 (2.74)	PE 0.116 (2.95)	36 TC 0.139 (3.53)	XLPE 0.195 (4.95)	0.03 (0.045)	50 +/- 2 65.9	30.8 (101.1)	1,900	-22 +185 (-30 +85)	0.05- 1.0 GHz Swept
LS-RG214 M17/190-00001	17-05-92	AA-7289	SC 7/.0296 0.089 (2.26)	PE 0.285 (7.24)	34 SC:34SC 0.343 (8.71)	XLPE 0.425 (10.80)	0.154 (0.229)	50 +/- 2 65.9	30.8 (101.1)	5,000	-22 +185 (-30 +85)	0.05- 11 GHz Swept
LS-RG223 M17/194-00001	17-05-92	AA-7294	SC 0.035 (0.89)	PE 0.116 (2.95)	36 SC:36 SC 0.162 (4.11)	XLPE 0.212 (5.38)	0.044 (0.066)	50 +/- 2 65.9	30.8 (101.1)	1,900	-22 +185 (-30 +85)	0.05 2.5 GHz Swept

See page 9 for materials abbreviations.



Frequency (MHz)	10	30	50	100	400	1,000	1,500	2,000	2,500	3,000	11,000	k1	k2
M17/183 (LSRG-58)	1.4	2.5	3.2	4.6	9.4	15	-	-	-	-	-	0.44400	0.00126
M17/194 (LSRG-223)	1.2	2.1	2.8	4.0	8.2	13	17	20	22	25	54	0.38400	0.00126
M17/180 (LSRG-6)	0.8	1.4	1.9	2.7	5.6	9.4	-	-	-	-	-	0.25600	0.00126
M17/181 (LSRG-11)	0.7	1.1	1.5	2.2	4.6	7.7	-	-	-	-	-	0.20300	0.00126
M17/190 (LSRG-214)	0.6	1.1	1.4	2.0	4.3	7.3	9.2	11.0	12.7	14.2	33.8	0.19000	0.00126

Attenuation at Any Frequency = [ k1 x  $\sqrt{Fmhz}$  ] + [ k2 x Fmhz ]; dB per 100 feet



Power Handling vs. Frequency (Typical)

Frequency (MHz)	10	30	50	100	400	1,000	1,500	2,000	2,500	3,000	11,000
M17/190 (LSRG-214)	3611	2053	1573	1091	512	302	237	198	172	153	63
M17/181 (LSRG-11)	2477	1409	1081	751	353	209	-	-	-	-	-
M17/180 (LSRG-6)	1718	980	753	525	250	149	-	-	-	-	-
M17/194 (LSRG-223)	1568	898	691	483	233	141	113	95	84	75	33
M17/183 (LSRG-58)	1436	822	634	444	215	131	-	-	-	-	-

Watts; Sea Level; Ambient +40C; VSWR 1:1

# LLSB® Low Loss Military/Shipboard Coax

## MIL-C-17 Qualified

- Low Loss Air Frame, Shipboard, Ground (Tactical) Interconnect
- Fire Retardant / Low Smoke (non-halogen)
- Flexible For Easy Deployment / Routing



### Features & Benefits

- Lower Loss
- Superior Shielding

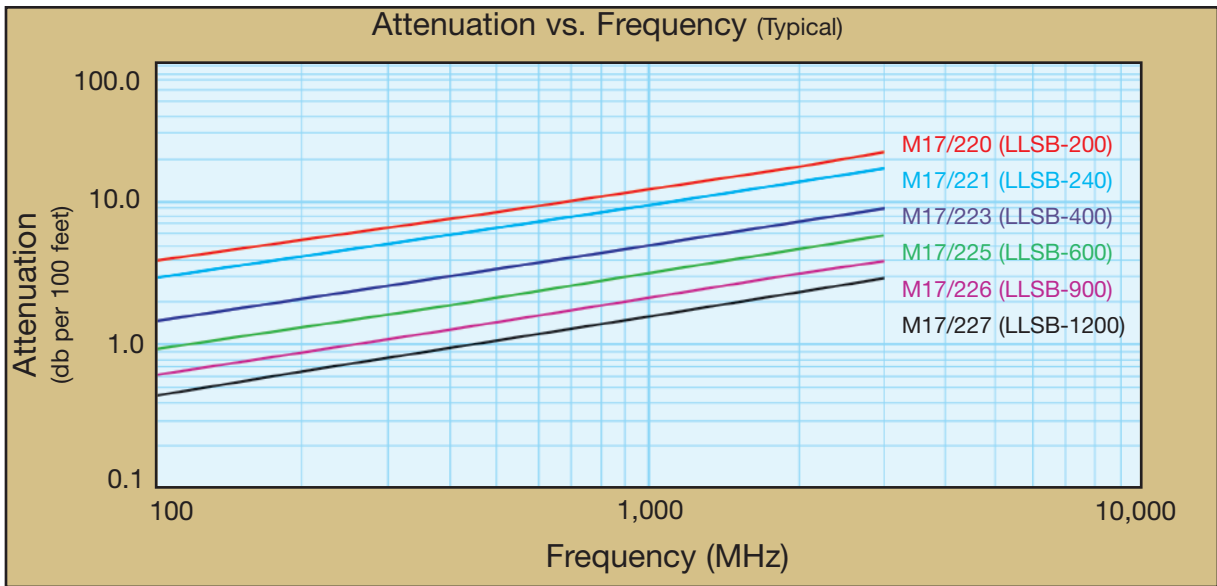
### Effectiveness

- Fire Retardant (non-halogen)
- Light Weight
- Flexible for Ease of Deployment
- Excellent Connector Selection

- **Flexible:** With very tight minimum bend radius, LLSB cable can be easily routed into and through tight spaces without kinking. The bonded-tape outer conductor provides superior flexibility and ease of bending compared to previous generation M17/RG type, corrugated copper, or smooth wall copper hard-line cables.
- **Low Loss:** LLSB has lower loss than other cables of the same size. This is achieved through the use of a high velocity dielectric and bonded aluminum tape outer conductor. The proprietary gas-injected closed cell foam dielectric prevents water migration through the cable and provides excellent crush resistance.
- **Fire Retardant:** A black UV resistant non-halogen, low smoke - fire retardant, cross-linked polyethylene jacket makes the cable rugged and resistant to the full range of military/defense environments. LLSB easily achieves FAR 25, NES-711, NES-713 compliance.
- **RF Shielding:** The bonded aluminum tape outer conductor is overlapped to provide 100% coverage, resulting in >90 dB RF shielding (>180 dB crosstalk) and excellent interference immunity (ingress and egress).
- **Phase Stability:** The intimately bonded structure and foam dielectric of LLSB cables provide excellent phase stability over temperature and with bending. The high velocity dielectric results in superior phase stability as compared with solid and air-spaced dielectric cables.
- **Connectors and Assemblies:** A full range of connector interfaces is available in crimp or clamp styles in addition to supporting installation tools. Custom preterminated and tested assemblies with phase matching, insertion loss matching, and other special electrical or marking requirements can also be provided.
- **Reference:** See page 9 for complete listing of qualified M17/220-/229 constructions.

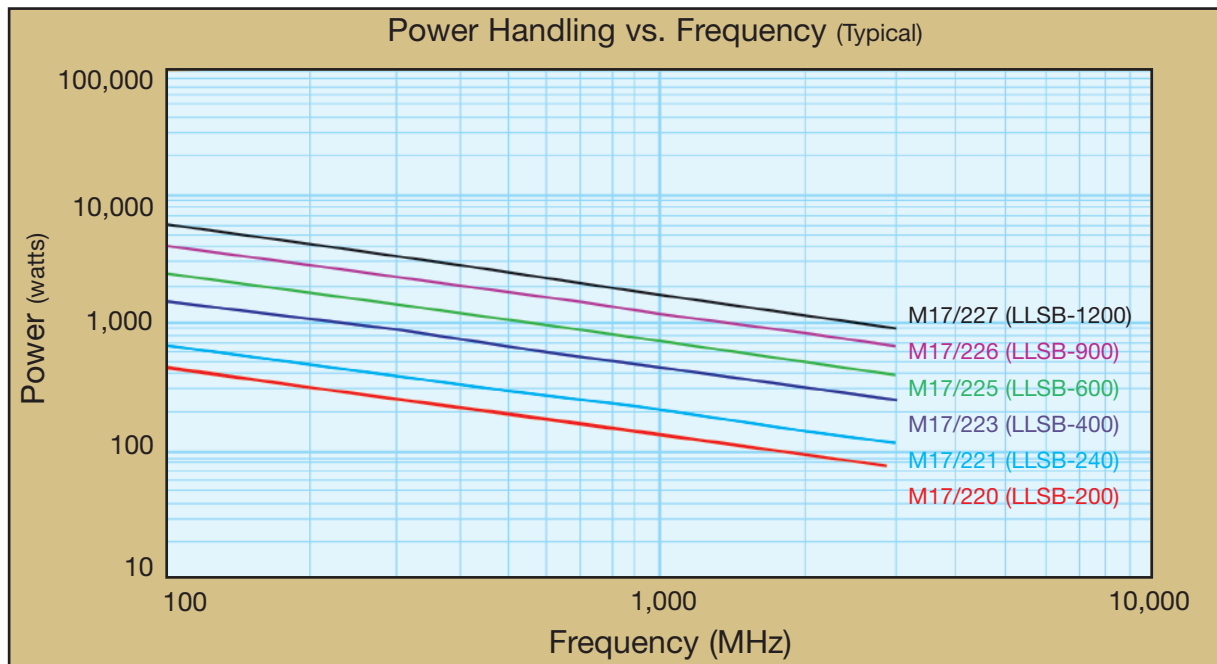
TMS M17 No.	M17 QPL No.	TMS Dwg No.	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Min. Bend Radius inches (mm)	Weight lbs/ft (kg/m)	Imped. (ohms) Vp (%)	Capacitance pF/ft (pF/m)	Max. Op Voltage vms	Temp. Range F (C)	M17 Test Frequency (max)
LLSB-200 M17/220-00001	17-041-99	AA-8469	BC	Foam PE	Alum Tape; 36TC	XLPE	1.0	0.037	50 +/- 2	24.5	1,000	-22 +185	0.05- 2.5 GHz Swept
			0.044 (1.12)	0.116 (2.95)	0.144 (3.66)	0.195 (4.95)	(25.4)	(0.055)	83 (80.4)	(-30 +85)			
LLSB-240 M17/221-00001	17-041-99	AA-8470	BC	Foam PE	Alum Tape; 36TC	XLPE	1.25	0.051	50 +/- 2	24.2	1,500	-22 +185	0.05- 2.5 GHz Swept
			0.056 (1.42)	0.150 (3.81)	0.178 (4.52)	0.242 (6.15)	(31.8)	(0.076)	84 (79.4)	(-30 +85)			
LLSB-400 M17/223-00001	17-041-99	AA-8471	BCCAI	Foam PE	Alum Tape; 34TC	XLPE	2.0	0.114	50 +/- 2	23.9	3,000	-22 +185	0.05- 2.5 GHz Swept
			0.108 (2.74)	0.285 (7.24)	0.320 (8.13)	0.405 (10.29)	(50.8)	(0.170)	85 (78.4)	(-30 +85)			
LLSB-600 M17/225-00001	17-041-99	AA-8473	BCCAI	Foam PE	Alum Tape; 33TC	XLPE	3.0	0.168	50 +/- 2	23.4	5,000	-22 +185	0.05 2.5 GHz Swept
			0.176 (4.47)	0.455 (11.56)	0.490 (12.45)	0.590 (14.99)	(76.2)	(0.250)	87 (76.8)	(-30 +85)			
LLSB-900 M17/226-00001	17-041-99	AA-8474	BC Tube	Foam PE	Alum Tape; 30TC	XLPE	4.5	0.375	50 +/- 2	23.4	7,000	-22 +185	0.05- 2.5 GHz Swept
			0.262 (6.65)	0.680 (17.27)	0.732 (18.59)	0.870 (22.10)	(114.3)	(0.559)	87 (76.8)	(-30 +85)			
LLSB-1200 M17/227-00001	17-041-99	AA-8475	BC Tube	Foam PE	Alum Tape; 30TC	XLPE	6.0	0.686	50 +/- 2	23.1	8,000	-22 +185	0.05 2.5 GHz Swept
			0.349 (8.86)	0.920 (23.37)	0.972 (24.69)	1.200 (30.48)	(152.4)	(1.022)	88 (75.8)	(-30 +85)			

See page 9 for materials abbreviations.



Frequency (MHz)	10	30	50	100	400	1,000	1,500	2,000	2,500	3,000	k1	k2
M17/220 (LLSB-200)	1.2	2.1	2.7	3.8	7.7	12	15	18	20	22	0.37753	0.000380
M17/221 (LLSB-240)	0.9	1.6	2.0	2.9	5.8	9	12	13	15	17	0.28480	0.000380
M17/223 (LLSB-400)	0.5	0.8	1.0	1.5	3.0	4.9	6.0	7.0	8.0	9	0.14387	0.000306
M17/225 (LLSB-600)	0.3	0.5	0.6	0.9	1.9	3.1	3.9	4.6	5.2	5.8	0.08888	0.000306
M17/226 (LLSB-900)	0.2	0.3	0.4	0.6	1.3	2.1	2.6	3.1	3.5	3.9	0.06091	0.000188
M17/227 (LLSB-1200)	0.1	0.2	0.3	0.5	1.0	1.6	2.0	2.3	2.7	3.0	0.04396	0.000188

Attenuation at Any Frequency = [ k1 x  $\sqrt{\text{Fmhz}}$  ] + [ k2 x Fmhz ]; dB per 100 feet



Power Handling vs. Frequency (Typical)

Frequency (MHz)	10	30	50	100	400	1,000	1,500	2,000	2,500	3,000
M17/227 (LLSB-1200)	18953	10835	8337	5823	2795	1689	1342	1137	998	895
M17/226 (LLSB-900)	13044	7477	5763	4038	1959	1197	958	815	718	647
M17/225 (LLSB-600)	8172	4680	3605	2523	1219	742	592	503	443	398
M17/223 (LLSB-400)	4927	2830	2184	1534	750	462	371	318	281	254
M17/221 (LLSB-240)	2205	1268	979	689	339	210	169	145	129	117
M17/220 (LLSB-200)	1459	840	649	457	225	140	113	97	86	78

Watts; Sea Level; Ambient +40C; VSWR 1:1

## M17/MIL-C-17 Coaxial Cable Specifications

M17 Part No.	M17 QPL	TMS Part No.	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Armor inches (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Max Oper. Voltage vrms	Temp. Range F (C)	M17 Test Frequency	Comments
M17/180-00001	17-05-92	AA-7276	CCS 0.0285 (0.72)	PE 0.185 (4.70)	34SC:34BC 0.243 (6.17)	XLPE 0.332 (8.43)	NA	0.092 (0.137)	75 +/-3 66	20.6 (67.6)	2,700	-22 +176 (-30 +80)	3 GHz UnSwept	Non-halogen Low smoke M17/2-RG6
M17/181-00001	17-05-92	AA-7277	TC 7/.0159 0.0477 (1.21)	PE 0.285 (7.24)	33BC 0.318 (8.08)	XLPE 0.405 (10.29)	NA	0.108 (0.161)	75 +/-3 66	20.6 (67.6)	5,000	-22 +176 (-30 +80)	1 GHz UnSwept	Non-halogen Low smoke M17/6-RG11
M17/181-00002	17-05-92	AA-7278	TC 7/.0159 0.0477 (1.21)	PE 0.285 (7.24)	34BC 0.318 (8.08)	XLPE 0.405 (10.29)	Alum. Braid 0.475 (12.07)	0.132 (0.197)	75 +/-3 66	20.6 (67.6)	5,000	-22 +176 (-30 +80)	1 GHz UnSwept	Armored M17/181-00001
M17/182-00001	17-05-92	AA-7279	2C:BC 7/.0152 0.0456 (1.16)	PE 0.285 (7.24)	34TC:34TC 0.343 (8.71)	XLPE 0.405 (10.67)	NA	0.142 (0.212)	95 +/-5 66	16.3 (53.5)	1,000	-22 +176 (-30 +80)	200 MHz UnSwept	Non halogen Low smoke M17/15-RG22
M17/182-00002	17-05-92	AA-7280	2C:BC 7/.0152 0.0456 (1.16)	PE 0.285 (7.24)	34TC:34TC 0.343 (8.71)	XLPE 0.420 (10.67)	Alum. Braid 0.490 (12.45)	0.169 (0.252)	95 +/-5 66	16.3 (53.5)	1,000	-22 +176 (-30 +80)	200 MHz UnSwept	Armored M17/182-00001
M17/183-00001	17-05-92	AA-7281	TC 19/.0072 0.0355 (0.90)	PE 0.116 (2.95)	36TC 0.139 (3.53)	XLPE 0.195 (10.67)	NA	0.030 (0.045)	50 +/-2 66	30.8 (101.1)	1,900	-22 +176 (-30+80)	0.05-1 GHz Swept	Non-halogen Low smoke M17/28-RG58
M17/184-00001	17-05-92	AA-7282	CCS 0.0226 (0.57)	PE 0.146 (3.71)	34BC 0.175 (4.45)	XLPE 0.242 (6.15)	NA	0.043 (0.064)	75 +/-3 66	20.6 (67.6)	2,300	-22 +176 (-30 +80)	1 GHz UnSwept	Non-halogen Low smoke M17/29-RG59
M17/185-00001	17-05-92	AA-7283	CCS 0.0253 (0.64)	Air spaced PE 0.146 (3.71)	34BC 0.175 (4.45)	XLPE 0.242 (6.15)	NA	0.042 (0.063)	93 +/-5 81	13.5 (44.3)	750	-22 +176 (-30 +80)	1 GHz UnSwept	Non-halogen Low smoke M17/30-RG62
M17/186-00001	17-05-92	AA-7284	2C:TC 7/.0126 0.0378 (0.96)	PE (each) 0.079 (2.01)	36TC 0.181 (4.60)	XLPE 0.235 (5.97)	NA	0.041 (0.061)	75 +/-3 68	19.6 (64.3)	1,000	-22 +176 (-30 +80)	10 MHz UnSwept	Non-halogen Low smoke M17/45-RG108
M17/187-00001	17-05-92	AA-7285	TC 27/.005 0.0308 (0.78)	PE 0.185 (2.44)	36TC 0.119 (3.02)	XLPE 0.160 (4.06)	NA	0.023 (0.034)	50 +/-2 66	30.8 (101.1)	1,900	-22 +176 (-30 +80)	0.05-1 GHz Swept	Non-halogen Low smoke M17/54-RG122
M17/188-00001	17-05-92	AA-7286	SC 0.0556 (1.41)	PE 0.185 (2.44)	34SC:34SC 0.243 (6.17)	XLPE 0.332 (8.43)	NA	0.099 (0.147)	50 +/-2 66	30.8 (101.1)	3,000	-22 +176 (-30 +80)	0.05-11 GHz Swept	Non-halogen Low smoke M17/73-RG212
M17/189-00001	17-05-92	AA-7287	BC 7/.0296 0.0888 (2.26)	PE 0.285 (7.24)	33BC 0.318 (8.08)	XLPE 0.405 (10.29)	NA	0.121 (0.180)	50 +/-2 66	30.8 (101.1)	5,000	-22 +176 (-30 +80)	0.05-1GHz Swept	Non-halogen Low smoke M17/74-RG213
M17/189-00002	17-05-92	AA-7288	BC 7/.0296 0.0888 (2.26)	PE 0.285 (7.24)	33BC 0.318 (8.08)	XLPE 0.405 (10.29)	Alum. Braid 0.475 (12.07)	0.146 (0.217)	50 +/-2 66	30.8 (101.1)	5,000	-22 +176 (-30 +80)	0.05-1 GHz Swept	Armored M17/189-00001
M17/190-00001	17-05-92	AA-7289	SC 7/.0296 0.0888 (2.26)	PE 0.285 (7.24)	34SC:34SC 0.343 (8.71)	XLPE 0.425 (10.80)	NA	0.154 (0.229)	50 +/-2 66	30.8 (101.1)	5,000	-22 +176 (-30 +80)	0.05-11 GHz Swept	Non-halogen Low smoke M17/75-RG214
M17/191-00001	17-05-92	AA-7290	TC 7/.0159 0.0477 (1.21)	PE 0.285 (7.24)	34BC:34BC 0.343 (8.71)	XLPE 0.425 (10.80)	NA	0.139 (0.207)	75 +/-3 66	20.6 (67.6)	5,000	-22 +176 (-30 +80)	3 GHz UnSwept	Non-halogen Low smoke M17/77-RG216
M17/192-00001	17-05-92	AA-7291	BC 0.106 (2.69)	PE 0.370 (9.40)	33BC:33BC 0.436 (11.07)	XLPE 0.545 (13.84)	NA	0.248 (0.369)	50 +/-2 66	30.8 (101.1)	7,000	-22 +176 (-30 +80)	0.05-3 GHz Swept	Non-halogen Low smoke M17/78-RG217
M17/192-00002	17-95-94	AA-8111	BC 0.106 (2.69)	PE 0.370 (9.40)	30BC 0.436 (11.07)	XLPE 0.545 (13.84)	NA	0.248 (0.369)	50 +/-2 66	30.8 (101.1)	7,000	-22 +176 (-30 +80)	0.05-3 GHz Swept	M17/192-00001 with temperature cycling
M17/193-00001	17-05-92	AA-7292	BC 0.195 (4.95)	PE 0.680 (17.27)	30BC 0.726 (18.44)	XLPE 0.870 (22.10)	NA	0.521 (0.776)	50 +/-2 66	30.8 (101.1)	11,000	-22 +176 (-30 +80)	0.05-1 GHz Swept	Non-halogen Low smoke M17/79-RG218
M17/193-00002	17-05-92	AA-7293	BC 0.195 (4.95)	PE 0.680 (17.27)	30BC 0.726 (18.44)	XLPE 0.870 (22.10)	Alum. Braid 0.945 (24.00)	0.571 (0.851)	50 +/-2 66	30.8 (101.1)	11,000	-22 +176 (-30 +80)	0.05-1 GHz Swept	Armored M17/193-00001
M17/194-00001	17-05-92	AA-7294	SC 0.0350 (0.89)	PE 0.116 (2.95)	36SC:36SC 0.160 (4.11)	XLPE 0.212 (5.38)	NA	0.044 (0.066)	50 +/-2 66	30.8 (101.1)	1,900	-22 +176 (-30 +80)	0.04-12.4 GHz Swept	Non-halogen Low smoke M17/84-RG223
M17/195-00001	17-05-92	AA-7295	CCS 0.0253 (0.64)	Air Space PE 0.146 (3.71)	34BC:34TC 0.198 (5.03)	XLPE 0.245 (2.79)	NA	0.053 (0.079)	93 +/-5 85	13.5 (44.3)	750	-22 +176 (-30 +80)	1 GHz UnSwept	Non-halogen Low smoke M17/90-RG71
M17/196-00001	17-05-92	AA7296	CCS 7/.0063 0.0189 (0.48)	PE 0.060 (1.52)	38TC 0.078 (1.98)	XLPE 0.110 (2.79)	NA	0.009 (0.013)	50 +/-2 66	30.8 (101.1)	1,500	-22 +176 (-30 +80)	0.05-1 GHz Swept	Non-halogen Low smoke M17/119-RG174
M17/197-00001	17-05-92	AA-7297	TC 19/.0072 0.0355 (0.90)	PE 0.116 (2.95)	36TC 0.139 (3.53)	XLPE 0.195 (4.95)	NA	0.0310 (0.046)	50 +/-2 66	30.8 (101.1)	1,500	-22 +176 (-30 +80)	400 MHz UnSwept	Non-halogen Low Smoke M17/155-00001
M17/198-00001	17-05-92	AA-7298	TC 27/.005 0.0308 (0.78)	PE 0.096 (2.44)	36TC 0.119 (3.02)	XLPE 0.160 (4.06)	NA	0.024 (0.036)	50 +/-2 66	30.8 (101.1)	1,900	-22 +176 (-30 +80)	400 MHz UnSwept	Non-halogen Low smoke M17/157-00001
M17/199-00001	17-05-92	AA-7299	SC 0.0556 (1.41)	PE 0.185 (4.70)	34SC:34SC 0.243 (6.17)	XLPE 0.332 (8.43)	NA	0.100 (0.149)	50 +/-2 66	30.8 (101.1)	3,000	-22 +176 (-30 +80)	400 MHz UnSwept	Non-halogen Low Smoke M17/162-00001

M17 Part No.	M17 QPL	TMS Part No.	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Armor inches (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Max Oper. Voltage vrms	Temp. Range F (C)	M17 Test Frequency	Comments
M17/200-00001	17-05-92	AA-7300	SC 0.035 (0.89)	PE 0.116 (2.95)	36SC:36SC 0.162 (4.11)	XLPE 0.212 (5.38)	NA	0.044 (0.066)	50 +/-2 66	30.8 (101.1)	19,000	-22 +176 (-30 +80)	400 MHz UnSwept	Non-halogen Low smoke M17/167-00001
M17/210-00001	17-05-92	AA-3404	BC 0.195 (4.95)	PE 0.680 (17.27)	34SC:34SC 0.738 (18.75)	XLPE 0.895 (22.73)	NA	0.572 (0.852)	50 +/-2 66	32.2 (105.6)	11,000	-40 +176 (-40 +80)	1GHz UnSwept	Non-halogen Low smoke M17/67-RG177
M17/220-00001	17-041-99	AA-8469	BC 0.044 (1.12)	Foam PE 0.116 (2.95)	36TC: Al Tape 0.144 (3.66)	XLPE 0.195 (4.95)	NA	0.037 (0.055)	50 +/-2 83	24.5 (80.4)	1,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/220-00002	17-041-99	AA-8897	BC 0.044 (1.12)	Foam PE 0.116 (2.95)	36TC: Al Tape 0.144 (3.66)	XLPE 0.195 (4.95)	Alum. Braid 0.265 (6.73)	0.051 (0.076)	50 +/-2 83	24.5 (80.4)	1,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/220-00001
M17/221-00001	17-041-99	AA-8470	BC 0.056 (1.42)	Foam PE 0.150 (3.81)	36TC: Al Tape 0.178 (4.52)	XLPE 0.242 (6.15)	NA	0.051 (0.076)	50 +/-2 84	24.2 (79.4)	1,500	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/221-00002	17-041-99	AA-8898	BC 0.056 (1.42)	Foam PE 0.150 (3.81)	36TC: Al Tape 0.178 (4.52)	XLPE 0.242 (6.15)	Alum. Braid 0.312 (7.92)	0.066 (0.098)	50 +/-2 84	24.2 (79.4)	1,500	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/221-00001
M17/222-00001	17-041-99	AA-8681	BC 0.070 (1.78)	Foam PE 0.190 (4.83)	34TC: Al Tape 0.225 (5.72)	XLPE 0.300 (7.62)	NA	0.087 (0.130)	50 +/-2 85	24.1 (79.1)	2,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/222-00002	17-041-99	AA-8899	BC 0.070 (1.78)	Foam PE 0.190 (4.83)	34TC: Al Tape 0.225 (5.72)	XLPE 0.300 (7.62)	Alum. Braid 0.370 (9.40)	0.105 (0.158)	50 +/-2 85	24.1 (79.1)	2,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/222-00001
M17/223-00001	17-041-99	AA-8471	BCCAI 0.108 (2.74)	Foam PE 0.285 (7.24)	34TC: Al Tape 0.320 (8.13)	XLPE 0.405 (10.29)	NA	0.114 (0.170)	50 +/-2 85	23.9 (78.4)	3,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/223-00002	17-041-99	AA-8900	BCCAI 0.108 (2.74)	Foam PE 0.285 (7.24)	34TC: Al Tape 0.320 (8.13)	XLPE 0.405 (10.29)	Alum. Braid 0.475 (12.07)	0.140 (0.209)	50 +/-2 85	23.9 (78.4)	3,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/223-00001
M17/224-00001	17-041-99	AA-8472	BCCAI 0.142 (3.61)	Foam PE 0.370 (9.40)	30TC: Al Tape 0.409 (10.39)	XLPE 0.500 (12.70)	NA	0.132 (0.197)	50 +/-2 86	23.6 (77.4)	4,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/224-00002	17-041-99	AA-8901	BCCAI 0.142 (3.61)	Foam PE 0.370 (9.40)	34TC: Al Tape 0.409 (10.39)	XLPE 0.500 (12.70)	Alum. Braid 0.570 (14.48)	0.163 (0.243)	50 +/-2 86	23.6 (77.4)	4,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/224-00001
M17/225-00001	17-041-99	AA-8473	BCCAI 0.176 (4.47)	Foam PE 0.455 (11.56)	34TC: Al Tape 0.490 (12.45)	XLPE 0.590 (14.99)	NA	0.168 (0.250)	50 +/-2 87	23.4 (76.8)	5,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/225-00002	17-041-99	AA-8902	BCCAI 0.176 (4.47)	Foam PE 0.455 (11.56)	34TC: Al Tape 0.490 (12.45)	XLPE 0.590 (14.99)	Alum. Braid 0.665 (16.89)	0.204 (0.304)	50 +/-2 87	23.4 (76.8)	5,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/225-00001
M17/226-00001	17-041-99	AA-8474	BC Tube 0.262 (6.65)	Foam PE 0.680 (17.27)	30TC: Al Tape 0.732 (18.59)	XLPE 0.870 (22.10)	NA	0.375 (0.559)	50 +/-2 87	23.4 (76.8)	7,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/226-00002	17-041-99	AA-8903	BC Tube 0.262 (6.65)	Foam PE 0.680 (17.27)	30TC: Al Tape 0.732 (18.59)	XLPE 0.870 (22.10)	Alum. Braid 0.945 (24.00)	0.427 (0.636)	50 +/-2 87	23.4 (76.8)	7,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/226-00001
M17/227-00001	17-041-99	AA-8475	BC Tube 0.349 (8.86)	Foam PE 0.920 (23.37)	30TC: Al Tape 0.972 (24.69)	XLPE 1.200 (30.48)	NA	0.686 (1.022)	50 +/-2 88	23.1 (75.8)	8,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/227-00002	17-041-99	AA-8904	BC Tube 0.349 (8.86)	Foam PE 0.920 (23.37)	30TC: Al Tape 0.972 (24.69)	XLPE 1.200 (30.48)	Alum. Braid 1.300 (33.02)	0.758 (1.129)	50 +/-2 88	23.1 (75.8)	8,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/227-00001
M17/228-00001	17-041-99	AA-8476	BC Tube 0.527 (13.39)	Foam PE 1.350 (34.29)	30TC: Al Tape 1.401 (35.59)	XLPE 1.670 (42.42)	NA	1.05 (1.564)	50 +/-2 89	22.8 (74.8)	10,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/228-00002	17-041-99	AA-8905	BC Tube 0.527 (13.39)	Foam PE 1.350 (34.29)	30TC: Al Tape 1.401 (35.59)	XLPE 1.670 (42.42)	Alum. Braid 1.300 (33.02)	1.13 (1.683)	50 +/-2 89	22.8 (74.8)	10,000	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/228-00001
M17/229-00001	17-076-1	AA-9043	BC 0.032 (0.81)	Foam PE 0.150 (3.81)	36TC: Al Tape 0.178 (3.96)	XLPE 0.242 (6.15)	N/A	0.049 (0.072)	75 +/-3 87	17.2 (56.4)	1,200	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Non-halogen Low smoke Low loss
M17/229-00002	17-076-1	AA-9044	BC 0.032 (0.81)	Foam PE 0.150 (3.81)	36TC: Al Tape 0.178 (3.96)	XLPE 0.242 (6.15)	Alum. Braid 0.312 (7.42)	0.064 (0.095)	75 +/-3 87	17.2 (56.4)	1,200	-22 +185 (-30 +85)	0.05-2.5 GHz Swept	Armored M17/229-00001

## Materials Abbreviations

AL = Aluminum, BC = Bare Copper, BCCAI = Bare Copper Clad Aluminum, BCCS=Bare Copper Covered Steel, CCS = Bare Copper Clad Steel, FSC = Flat Silver Plated Copper, Intl = Interlayer Tape (Aluminum Polyester), Int = XLPE, Interlayer, Ivs = Intergal Vapor Seal, PE = Polyethylene, Quadshield= Aluminum Braids/Tapes, SC = Silver PLated Copper, TC = Tinned Copper, XLPE = Crosslinked Polyethylene

In addition to the MIL-C-17 qualified products listings, Times Microwave Systems has also been approved by NAVSEA for a wide range of low-smoke designs specified for shipboard use. The table below lists these NAVSEA designs.

## NAVSEA Approved Low-Smoke Coaxial/Triaxial Cables

NAVSEA No	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Weight lbs/ft (kg/m)	Impedance (ohms)	Capacitance pF/ft (pF/m)	Velocity (%)	Temp. Range F (C)	Frequency Range Attenuation Typical
6323052 50 Ohm	19/25 SPC 0.089 (2.26)	Foam PE 0.239 (6.07)	Double SPC 0.30 (7.62)	XLPE 0.415 (10.54)	0.12 (0.179)	50 +/- 2	24.5 (80.38)	80	-40 +185 (-40 +85)	.01 to 5.0 GHz 23 dB/100' @ 5.0 GHZ
6323054 75 Ohm	19/30 TPC 0.48 (1.22)	Foam PE 0.227 (5.77)	Double TPC 0.29 (7.37)	XLPE 0.420 (10.67)	0.132 (0.197)	75 +/- 3	19.0 (62.34)	76	-40 +185 (-40 +85)	.01 to 1.0 GHz 10 dB/100' @ 1.0 GHZ
6323056 50 Ohm Triax	19/32 TPC 0.040 (1.02)	Foam PE 0.120 (3.05)	TPC/Int/TPC 0.21 (5.18)	XLPE 0.283 (7.19)	0.065 (0.097)	50 +/- 2	29.0 (95.15)	70	-40 +185 (-40 +85)	.01 to 1.0 GHz 21 dB/100' @ 1.0 GHZ
6323059 75 Ohm Triax	19/36 TPC 0.025 (0.64)	Foam PE 0.133 (3.38)	TPC/Int/TPC 0.22 (5.66)	XLPE 0.325 (8.26)	0.08 (0.119)	75 +/- 3	19.0 (62.34)	70	-40 +185 (-40 +85)	.05 to 1.0 GHz 18.5 dB/100' @ 1.0 GHZ
6322493 75 Ohm Triax	19/30 TPC 0.048 (1.22)	Foam PE 0.227 (5.77)	TPC/Int/TPC 0.36 (9.02)	XLPE 0.465 (11.81)	0.15 (0.223)	75 +/- 3	18.5 (60.70)	76	-40 +185 (-40 +85)	.01 to 1.0 GHz 10 dB/100' @ 1.0 GHZ
6262065 50 Ohm Triax	7/20 SPC 0.089 (2.26)	Foam PE 0.239 (6.07)	SPC/Int/SPC 0.35 (8.86)	XLPE 0.450 (11.43)	0.155 (0.231)	50 +/- 2	27.5 (90.23)	77	-40 +185 (-40 +85)	.01 to 1.0 GHz 8.2 dB/100' @ 1.0 GHZ

## Waterblocked, Low-Smoke Triaxial Cables

For applications that require watertightness in addition to the performance requirements of the LS/LT designs, Times is qualified to the M17/134 and M17/135 designs. These triaxial designs meet the 25 psi-6 hour watertightness test, as well as the 1000 psi-2 hour hydrostatic tests that are requirements of MIL-C-17.

## MIL-C-17 Waterblocked Triaxial Cables

M17 Part No.	M17 QPL	TMS Part No.	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Max Oper. Voltage vrms	Temp. Range F (C)	M17 Test Frequency	Comments
M17/134-00003	17-952-85	AA-7557	SC 0.033 (0.84)	PE 0.116 (2.95)	36SC-XLPE-36SC 0.198 (5.03)	XLPE 0.245 (6.22)	0.050 (0.074)	50 +/-2 66	32.2 (105.6)	1,900	-22 +185 (-30 +85)	.05-3 GHz Swept	Non-halogen Low smoke M17/134-00001
M17/134-00004	17-952-85	AA-7558	SC 0.033 (0.84)	PE 0.116 (2.95)	36SC-XLPE-36SC 0.198 (5.03)	XLPE 0.245 (6.22)	0.050 (0.074)	50 +/-2 66	32.2 (105.6)	1,900	-22 +185 (-30 +85)	.05-3 GHz Swept	Non-halogen Low smoke M17/134-00002
M17/135-00005	17-202-88	AA-7559	SC 0.081 (2.06)	PE 0.285 (7.24)	33SC-XLPE-33SC 0.398 (10.11)	XLPE 0.500 (12.70)	0.185 (0.276)	50 +/-2 66	32.0 (105.0)	5,000	-22 +185 (-30 +85)	.05-3 GHz Swept	Waterblocked Non-halogen Low smoke M17/135-00003
M17/135-00006	17-202-88	AA-7560	SC 0.081 (2.06)	PE 0.285 (7.24)	33SC-XLPE-33SC 0.398 (10.11)	XLPE 0.500 (12.70)	0.185 (0.276)	50 +/-2 66	32.0 (105.0)	5,000	-22 +185 (-30 +85)	.05-3 GHz Swept	Non-Waterblocked Non-halogen Low smoke M17/135-00004

See page 9 for materials abbreviations.

# TCom®-LS Low Loss Coaxial Cables

For applications that require repeated flexing and the need for excellent electrical performance, the TCOM-LS series offers a non-halogen, low smoke alternative to the more rigid MIL-C-28830 corrugated copper designs. Detailed data sheets are available upon request.

TMS Number	Conductor in (mm)	Dielectric in (mm)	Shields in (mm)	Jacket in (mm)	Weight lbs/foot (kg/m)	Impedance ohms	Capacitance pF/foot (pF/m)	Velocity (%)	Temperature Range F (C)	Frequency Range Attenuation (Typical)
TCOM-200-LS	BC	Foam PE	FSC:Intl:TC	XLPE + lvs	0.04	50 +/- 1	24.5	83	190	.05 to 10 GHz
	0.04	0.12	0.15	0.2					(-30 +100)	42 db/100' @ 10 GHz
	1.12	2.95	3.91	4.95	0.06		80.38			
TCOM-240-LS	BC	Foam PE	FSC:Intl:TC	XLPE + lvs	0.05	50 +/- 1	24.2	84	190	.05 to 10 GHz
	0.06	0.15	0.19	0.24					(-30 +100)	32 db/100' @ 10 GHz
	1.42	3.81	4.78	6.1	0.074		79.4			
TCOM-300-LS	BC	Foam PE	FSC:Intl:TC	XLPE + lvs	0.06	50 +/- 1	24.1	85	190	.05 to 10 GHz
	0.07	0.19	0.23	0.3					(-30 +100)	27 db/100' @ 10 GHz
	1.78	4.83	5.72	7.62	0.089		79.07			
TCOM-400-LS	BCCAI	Foam PE	FSC:Intl:TC	XLPE + lvs	0.08	50 +/- 1	23.9	85	190	.05 to 10 GHz
	0.11	0.29	0.33	0.41					(-30 +100)	17 db/100' @ 10 GHz
	2.74	7.24	8.38	10.29	0.119		78.42			
TCOM-500-LS	BCCAI	Foam PE	FSC:Intl:TC	XLPE + lvs	0.12	50 +/- 1	23.6	86	190	.05 to 10 GHz
	0.14	0.37	0.42	0.5					(-30 +100)	14 db/100' @ 10 GHz
	3.61	9.4	10.54	12.7	0.179		77.43			
TCOM-600-LS	BCCAI	Foam PE	FSC:Intl:TC	XLPE + lvs	0.16	50 +/- 1	23.4	87	190	.05 to 10 GHz
	0.18	0.455	0.5	0.59					(-30 +100)	12 db/100' @ 10 GHz
	4.47	11.56	12.7	14.99	0.238		76.78			

Attenuation vs. Frequency										
Frequency (MHz)	30	50	150	450	900	2,000	5,000	10,000	k1	k2
TCOM-200-LS	2.1	2.7	4.7	8.2	12	18	29	42	0.37753	0.00038
TCOM-240-LS	1.6	2.0	3.5	6.2	8.9	13	22	32	0.28480	0.00038
TCOM-300-LS	1.2	2.6	2.8	5.0	7.2	11	18	27	0.22580	0.00044
TCOM-400-LS	0.8	1.0	1.8	3.2	4.6	7.0	11.7	17	0.14387	0.00031
TCOM-500-LS	0.6	0.8	1.4	2.5	3.7	5.7	9.6	14	0.13640	0.00031
TCOM-600-LS	0.5	0.6	1.1	2.0	2.9	4.6	7.8	12	0.08888	0.00031

Attenuation at Any Frequency = [ k1 x  $\sqrt{Fmhz}$  ] + [ k2 x Fmhz ]; dB per 100 feet

Power Handling vs. Frequency									
Frequency (MHz)	30	50	150	450	900	2,000	5,000	10,000	
TCOM-600-LS	4680	3605	2044	1145	786	503	294	191	
TCOM-500-LS	3752	2893	1647	928	641	413	245	161	
TCOM-400-LS	2830	2184	1246	705	489	318	190	126	
TCOM-300-LS	1777	1371	783	443	307	200	120	80	
TCOM-240-LS	1268	979	561	319	222	145	88	59	
TCOM-200-LS	869	671	385	219	153	100	61	41	

Watts; Sea Level; Ambient +40C; VSWR 1:1

## CATV

The low smoke CATV cables are designed to provide a low loss shipboard entertainment system interconnect, yet meet the rigid shipboard requirements per MIL-C-17 "G". Detailed data sheets are available upon request.

TMS No	Conductor inches (mm)	Dielectric inches (mm)	Shields inches (mm)	Jacket inches (mm)	Weight lbs/ft (kg/m)	Impedance (ohms)	Capacitance pF/ft (pF/m)	Velocity (%)	Temp. Range F (C)	Frequency Range Attenuation Typical
AA-6899 LSRG-11 Quad	BCCS	Foam PE	Quadshield	XLPE	0.073	75 +/- 3	16.5	82	-40 +185	.05 to 1.0 GHz
	0.06 (1.63)	0.29 (7.24)	0.35 (8.79)	0.43 (11.02)	(0.109)		(54.14)		(-40 +85)	4.5 dB/100' @ 1.0 GHz
AA6900 LSRG-6 Quad	BCCS	Foam PE	Quadshield	XLPE	0.033	75 +/- 3	16.5	82	-40 +185	.05 to 1.0 GHz
	0.04 (1.02)	0.180 (4.57)	0.24 (6.12)	0.297 (7.54)	(0.049)		(54.14)		(-40 +85)	6.0 dB/100' @ 1.0 GHz
AA-6901 LSRG-59 Quad	BCCS	Foam PE	Quadshield	XLPE	0.027	75 +/- 3	16.5	82	-40 +185	.05 to 1.0 GHz
	0.034 (0.86)	0.146 (3.71)	0.21 (5.26)	0.262 (6.65)	(0.040)		(54.14)		(-40 +85)	7.7 dB/100' @ 1.0 GHz

See page 9 for materials abbreviations.