

Coaxial Cable Products for Civil Aviation



Introduction

Times Microwave Systems manufactures a broad range of commercial air RF products to meet even the most exacting electrical and mechanical requirements. From HF through Ka band, TMS has the right solution for communications, collision avoidance, navigation, remote sensing, and in-flight entertainment applications.

TMS cables feature low attenuation, light weight, high flexibility, and durable constructions to perform in the most challenging aerospace environments. We pair these cables with TMS custom-designed connectors to minimize return loss and simplify installation.

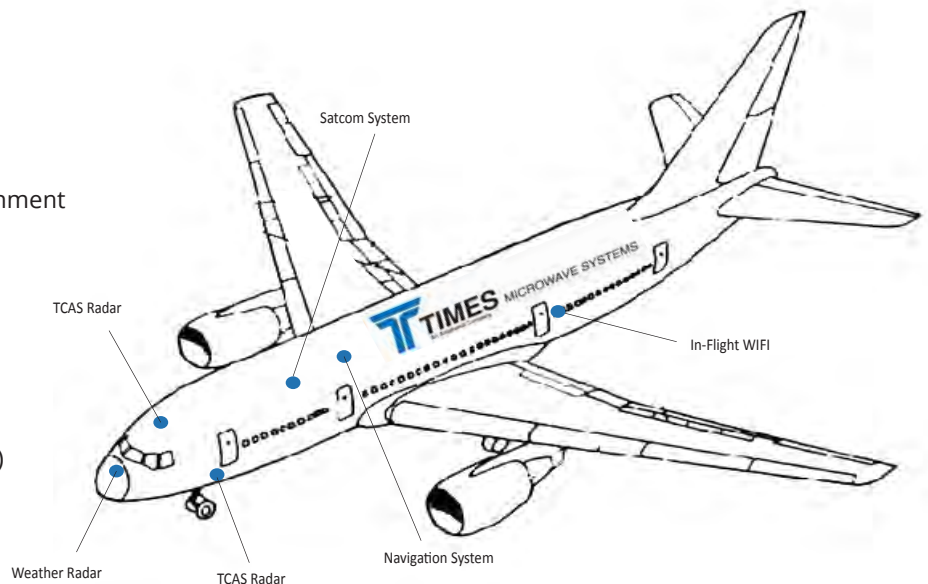
With a long history delivering to the civil and military aviation communities, Times understands its customers' needs for reliability, quality, certification, and delivery. Our products can be found on green aircraft of leading manufacturers and integrated into the most sophisticated after-market installations. Finally, our catalog is only a starting point: we can engineer customized solutions to meet your unique requirements in product design, installation, regulatory compliance, and performance improvement.

Features:

- Low loss & high flexibility
- Lightweight technology
- Broad temperature range
- High performance in shock and vibration environment
- Tested and qualified to MIL-DTL-17 standards

Typical Applications:

- Satcom System (L, Ku, Ka)
- ATG Communications (HF/VHF/UHF)
- Collision Avoidance (ADS-B/TCAS/TAS)
- Navigation System (GPS, XM Weather, VOR, NDB)
- ATG Cellular
- ELT
- Weather Radar



Qualifications:

Times Microwave Systems is registered and certified to AS900 Rev D / ISO9001:2015 Quality Management Systems. TMS Commercial Air cables have been qualified onto FAA and EASA Type Certificates. All LMR-FR, TCA, and MaxGain cables will all meet or exceed the flame test requirements of:

- | | |
|--------------------------|---------------------------------|
| • FAA Part 25 Appendix F | • BSS 7230 F1-F5 |
| • BSS 7238 | • BSS 7239 |
| • BSS 7322 | • ABD 0031: 7.1.2-5, 7.3.1, 7.4 |

Full Qualification Test Reports are available by contacting Times Microwave.

Sales:

Many Times Microwave ComAir products are available through distribution to meet even the most pressing of Aircraft On Ground (AOG) maintenance needs.

Find your local distributor at <http://www.timesmicrowave.com/Resources/Distributors>.

For custom or other inquiries, contact your Times Microwave Regional Sales Manager.

Product Portfolio

Cables

LMR® -FR

Fire retardant version of the highly-acclaimed LMR cable, both UL and CSA listed (CMR/CATVR)

TCA

Lightweight, low-loss, high-temperature, highly flexible cable for avionics and communications

MaxGain®

The lowest insertion loss available cable assembly for K-band SATCOM

Connectors

TMS cables pair with a wide range of connectors, including TNC, BNC, SMA, and N. TMS also offers female and right-angle versions of many of its connectors.

Accessories

Strip/Crimp Tools

Simplify installation with TMS' purpose-built strip and center-contact crimp tools

Blind Mate Antennas

Reduce maintenance time and eliminate service loops with blind mate antennas matched to TMS civil aviation cables

RF Filters

Manage antenna interference challenges with field-installable bandpass and bandgap filters

Bulkhead Pressure Feedthroughs

Achieve tight loss budgets with the lowest-attenuation design option for through-hull cable requirements

	LMR-FR	TCA	MaxGain
Communications			
HF	•	•	
VHF	•	•	
UHF	•	•	
Emergency Locator Transmitter (ELT)	•	•	
ATG Cellular	•	•	
SATCOM: L		•	•
SATCOM: Ku		•	•
SATCOM: Ka			•
Collision Avoidance			
ADS-B		•	
TCAS/Mode S		•	
TAS		•	
Navigation			
NDB/ADF	•	•	
ILS/GS/LOC/Marker Beacon	•	•	
VOR/DME	•	•	
GPS	•	•	
XM WX Satellite Weather	•	•	
Radar Altimeter		•	•
Sensing			
Weather Radar		•	•
External EO/IR Camera	•	•	
Onboard surveillance	•	•	
Cockpit Displays	•	•	



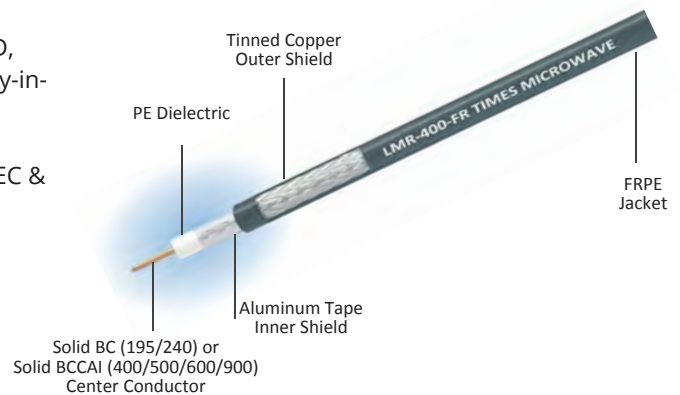
LMR®-FR

LMR®-FR is non-halogen (non-toxic), low smoke, fire retardant cable ideal for antenna runs, SATCOM feeders, and avionics systems. LMR-FR's custom-designed installation tools simplify field work and reduce FOD, while enabling designers to tap into the wide portfolio of existing, fully-interchangeable LMR connectors and tooling.

LMR®-FR meets FAA FAR Part 25 burn test requirements and is UL/NEC & CSA rated "CMR" and "FT4", respectively.

Features:

- Excellent flexibility
- Much lower loss than standard RG cables
- Superior RF Shielding effectiveness
- Available as fully tested, custom cable assemblies
- Superb connector availability and easy installation



Specifications:

	LMR-195-FR	LMR-240-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR	LMR-900-FR
Stock Code	54111	54029	54030	54031	54032	54033
Physical Specifications						
Description	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Inner Conductor	0.037 (0.94)	0.056 (1.42)	0.108 (2.74)	0.142 (3.61)	0.176 (4.47)	0.262 (6.65)
Dielectric	0.110 (2.79)	0.150 (3.81)	0.285 (7.24)	0.370 (9.40)	0.455 (11.56)	0.680 (17.27)
Inner Shield	0.116 (2.95)	0.155 (3.94)	0.291 (7.39)	0.376 (9.55)	0.461 (11.71)	0.686 (17.42)
Outer Shield	0.139 (3.53)	0.178 (4.52)	0.320 (8.13)	0.405 (10.29)	0.490 (12.45)	0.732 (18.59)
Jacket	0.195 (4.95)	0.240 (6.10)	0.405 (10.29)	0.500 (12.70)	0.590 (14.99)	0.870 (22.10)

	LMR-195-FR	LMR-240-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR	LMR-900-FR
Mechanical & Environmental Specifications						
Bend Radius: installation	0.50 (12.7)	0.75 (19.1)	1.00 (25.4)	1.25 (31.8)	1.50 (38.1)	3.00 (76.2)
Weight / lb/ft (kg/m)	0.021 (0.03)	0.034 (0.05)	0.068 (0.10)	0.097 (0.14)	0.131 (0.20)	0.266 (0.40)
Operating Temperature Range	-40°F / +185°F (-40°C / +85°C)					

	LMR-195-FR	LMR-240-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR	LMR-900-FR
Electrical Specifications						
Velocity of Propagation	80%	83%	84%	82%	85%	87%
Time Delay / nS/ft (nS/m)	1.27 (4.17)	1.21 (3.97)	1.20 (3.92)	1.18 (3.88)	1.17 (3.83)	1.17 (3.83)
Impedance / ohms	50	50	50	50	50	50
Capacitance / pF/ft (pF/m)	25.4 (83.3)	24.2 (79.4)	23.9 (78.4)	23.6 (77.5)	23.4 (76.6)	23.4 (76.6)
Shielding Effectiveness / dB	90	90	90	90	90	90

	LMR-195-FR	LMR-240-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR	LMR-900-FR
Attenuation: dB / 100ft (100m) (+25°C ambient)						
150 MHz	4.4 (14.6)	3.0 (9.9)	1.5 (5.0)	1.2 (4.0)	1.0 (3.2)	0.7 (2.2)
1000 MHz	11.8 (38.6)	8.0 (26.2)	4.1 (13.5)	3.3 (10.9)	2.6 (8.7)	1.8 (5.9)
1600 MHz	15.0 (49.3)	10.2 (33.5)	5.3 (17.4)	4.3 (14.0)	3.4 (11.3)	2.3 (7.6)
2400 MHz	18.6 (61.1)	12.7 (41.5)	6.6 (21.7)	5.4 (17.6)	4.3 (14.2)	2.9 (9.6)
5000 MHz	27.6 (90.5)	18.8 (61.6)	9.9 (32.6)	8.1 (26.7)	6.6 (21.8)	4.5 (14.6)

Calculate attenuation and power handling at any frequency using the calculator on the www.TimesMicrowave.com homepage

Connectors:

Cable Type	LMR-195-FR	LMR-240-FR	LMR-400-FR	LMR-500-FR	LMR-600-FR	LMR-900-FR
TNC Male Straight	TC-195-TM-X (3190-2879)	EZ-240-TM-X (3190-2725)	EZ-400-TM-X (3190-2533)	TC-500-TM-X (3190-6009)	EZ-600-TM-X (3190-2531)	NA
TNC Male Right Angle	NA	EZ-240-TM-RA-X (3190-2726)	EZ-400-TM-RA-X (3190-2800)	NA	EZ-600-TM-RA-X (3190-2999)	NA
TNC Female	NA	EZ-240-TF-X (3190-6204)	EZ-400-TF-X (3190-3049)	TC-500-TF-X (3190-6010)	EZ-600-TF-X (3190-3050)	NA
N Male Straight	TC-195-NMH-X (3190-2880)	EZ-240-NMH-X (3190-2893)	EZ-400-NMH-X (3190-2590)	EZ-500-NMH-X (3190-2596)	EZ-600-NMH-X (3190-2627)	EZ-900-NMC-2 (3190-1262)
N Male Right Angle	TC-195-NMH-RA (3190-2425)	EZ-240-NMH-RA-X (3190-6143)	EZ-400-NMH-RA-X (3190-2638)	TC-500-NMH-RA-D (3190-2970)	EZ-600-NMH-RA-X (3190-2639)	NA
N Female	NA	EZ-240-NF-X (3190-2795)	EZ-400-NF-X (3190-2818)	TC-500-NFC (3190-215)	EZ-600-NF-X (3190-2817)	EZ-900-NFC-2 (3190-1263)
SMA Male Straight	EZ-195-SM-X (3190-6140)	EZ-240-SM-X (3190-6319)	TC-400-SM-X (3190-3046)	TC-500-SMC (3190-249)	NA	NA
BNC Male Straight	EZ-195-SM-X (3190-6141)	EZ-240-BM-X (3190-6120)	EZ-400-BM-X (3190-2852)	NA	NA	NA
SMA Male Right Angle	NA	EZ-240-SM-RA-X (3190-2899)	NA	NA	NA	NA

Connectors and install tools for the perfect prep everytime!



Strip jacket and core



Crimp center pin



Fold braid over connector and crimp

TCA

Times Commercial Air (TCA) is a low-loss, high-temperature, high flexibility cable for navigation, collision avoidance, and communications systems. TCA is ideal for applications such as GPS, ADS-B, SATCOM, and ATG, especially when facing critical electrical and mechanical performance requirements.

Features:

- Excellent temperature performance (-55°C to +200°C)
- Significantly lighter than MIL-DTL-17 cables with superior loss characteristics
- High flexibility to enable routing through tight runs
- Wide connector availability and simple installation
- Available as fully tested, custom cable assemblies
- Multiple shielding layers to reduce interference

Key Applications:

Communications

- HF/VHF/UHF
- Emergency Locator Transmitter
- ATG Cellular
- SATCOM (L and Ku)

Collision Avoidance

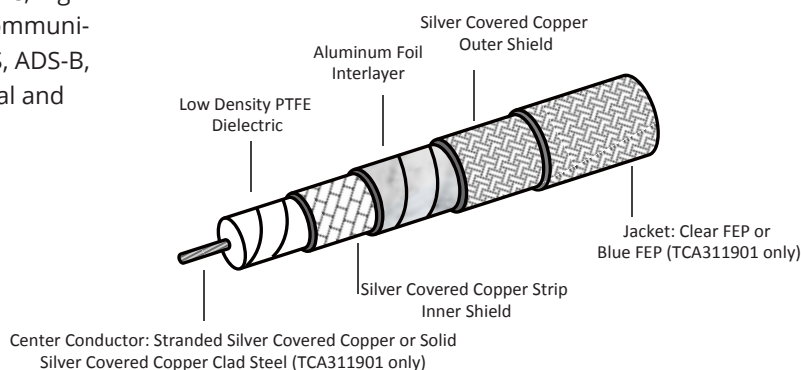
- ADS-B/TCAS/Mode-S/TAS

Sensing

- Onboard surveillance camera
- External EO/IR Camera

Navigation

- GPS
- Radar Altimeter
- ILS/Marker Beacon/GS/LOC
- VOR/DME
- NDB/ADF



	TCA311201	TCA311501	TCA311601	TCA311901	TCA352001
Stock Code	510-0155	510-0163	510-0158	510-0167	510-0159
Physical Specifications					
Description	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Inner Conductor	0.089 (2.26)	0.057 (1.44)	0.056 (1.42)	0.037 (0.93)	0.043 (1.09)
Dielectric	0.233 (5.91)	0.159 (4.03)	0.149 (3.78)	0.117 (2.97)	0.108 (2.74)
Inner Shield	0.241 (6.12)	0.167 (4.24)	0.157 (3.98)	0.127 (3.22)	0.122 (3.09)
Interlayer	0.246 (6.24)	0.174 (4.90)	0.163 (4.14)	0.133 (3.37)	-
Outer Shield	0.267 (6.78)	0.193 (5.81)	0.183 (4.64)	0.153 (3.88)	0.138 (3.50)
Jacket	0.317 (8.05)	0.229 (5.81)	0.229 (5.81)	0.195 (4.95)	0.162 (4.11)

	TCA311201	TCA311501	TCA311601	TCA311901	TCA352001
Mechanical and Environmental Specifications					
Bend Radius: Installation (in. / (mm))	1.59 (40.3)	1.20 (30.4)	1.15 (29.2)	1.0 (25.4)	0.8 (20.3)
Weight (lb/ft / (kg/m))	0.0086 (0.06)	0.05 (0.36)	0.05 (0.36)	0.043 (0.31)	0.027 (0.19)
Operating Temperature Range	-55°C to +200°C	-55°C to +200°C	-55°C to +200°C	-55°C to +200°C	-55°C to +200°C

	TCA311201	TCA311501	TCA311601	TCA311901	TCA352001
Electrical Specifications					
Velocity of Propagation (Nom.)	80%	80%	80%	70%	80%
Time Delay (nS/ft / (nS/m), Nom.)	1.27 (4.16)	1.27 (4.16)	1.27 (4.16)	1.46 (4.79)	1.25 (4.10)
Impedance (Ohms, Nom.)	50	50	50	50	50
Capacitance (pF/ft / (pF/m), Nom.)	25.5 (83.6)	25.5 (83.6)	25.5 (83.6)	29.3 (96.1)	25.5 (83.6)
Shielding Effectiveness (dB)	90	90	90	90	80

	TCA311201	TCA311501	TCA311601	TCA311901	TCA352001
Attenuation: dB / 100ft (100m) (+25°C ambient)					
150 MHz	2.1 (6.8)	2.7 (8.8)	3.3 (10.8)	4.3 (14.1)	4.5 (14.7)
1000 MHz	5.6 (18.3)	7.1 (23.2)	8.7 (28.5)	12.2 (40.0)	12.2 (40.0)
1600 MHz	6.7 (21.9)	9.1 (29.8)	10.9 (35.7)	15.8 (51.8)	14.8 (48.5)
2400 MHz	8.9 (29.1)	10.7 (35.1)	13.3 (43.6)	18.6 (61.0)	20.4 (66.9)
5000 MHz	12.7 (41.6)	16.1 (52.8)	20.0 (65.6)	30.0 (98.4)	26.4 (86.6)

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Connectors:

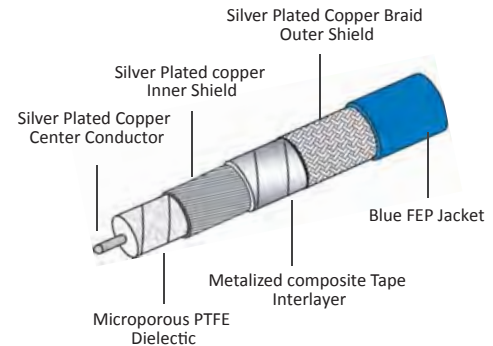
	TCA311201	TCA311501	TCA311601	TCA311901	TCA352001
TNC Male Straight	TC-201-TM-X (3190-8073)	TC-501-TM-X (3190-8075)	TC-601-TM-X (3190-8077)	TC-901-TM-X (3190-8079)	TC-001-TM-X (3190-8071)
TNC Male Right Angle	TC-201-TM-RA-X (3190-8074)	TC-501-TM-RA-X (3190-8076)	TC-601-TM-RA-X (3190-8078)	TC-901-TM-RA-X (3190-8080)	TC-001-TM-RA-X (3190-8072)
N Male Straight	TC-201-NM-X (3190-8063)	TC-501-NM-X (3190-8065)	TC-601-NM-X (3190-8067)	TC-901-NM-X (3190-8069)	TC-001-NM-X (3190-8061)
N Male Right Angle	TC-201-NM-RA-X (3190-8064)	TC-501-NM-RA-X (3190-8066)	TC-601-NM-RA-X (3190-8068)	TC-901-NM-RA-X (3190-8070)	TC-001-NM-RA-X (3190-8062)
BNC Male Straight	TC-201-BM-X (3190-8083)	TC-501-BM-X (3190-8085)	TC-601-BM-X (3190-8087)	TC-901-BM-X (3190-8089)	TC-001-BM-X (3190-8081)
BNC Male Right Angle	TC-201-BM-RA-X (3190-8084)	TC-501-BM-RA-X (3190-8086)	TC-601-BM-RA-X (3190-8088)	TC-901-BM-RA-X (3190-8090)	TC-001-BM-RA-X (3190-8082)
SMA Male Straight	TC-201-SM-X (3190-8053)	TC-501-SM-X (3190-8055)	TC-601-SM-X (3190-8057)	TC-901-SM-X (3190-8059)	TC-001-SM-X (3190-8051)
SMA Male Right Angle	TC-201-SM-RA-X (3190-8054)	TC-501-SM-RA-X (3190-8056)	TC-601-SM-RA-X (3190-8058)	TC-901-SM-RA-X (3190-8060)	TC-001-SM-RA-X (3190-8052)

MaxGain®

MaxGain® microwave assemblies are ideal for high-reliability applications where ultra-low loss or flexure stability are critical, such as Ku- and Ka-band SATCOM. Maxgain assemblies are fully customizable and are available fully tested.

Features:

- Lowest insertion loss available, DC – 50 GHz
- Ultra-stable insertion loss and VSWR with flexing
- Extremely flexible, low minimum bend radius
- Wide temperature range (-65°C to +150°C)
- Typical VSWR for assemblies is < 1.40:1 at maximum frequencies



	MG-300	MG-300S	MG-200	MG-160	MG-130
Sales Drawing	AA-9857	AA-9999	AA-9889	AA-11258	AA-11521
Physical Specifications					
Description	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Center Conductor	0.087 (2.20)	0.092 (2.33)	0.051 (1.29)	0.036 (0.91)	0.029 (0.74)
Dielectric	0.243 (6.17)	0.245 (6.22)	0.146 (3.70)	0.105 (2.67)	0.083 (2.11)
Shield	0.246 (6.24)	0.248 (6.29)	0.151 (3.83)	0.109 (2.77)	0.086 (2.18)
Interlayer	0.252 (6.40)	0.252 (7.01)	0.156 (3.96)	0.116 (2.95)	0.094 (2.39)
Outer Braid	0.276 (7.01)	0.276 (7.67)	0.174 (4.41)	0.134 (3.40)	0.108 (2.74)
Jacket	0.302 (7.67)	0.302 (7.67)	0.200 (5.08)	0.156 (3.96)	0.130 (3.30)

	MG-300	MG-300S	MG-200	MG-160	MG-130
Mechanical and Environmental Specifications					
Bend Radius: Installation (in. / (mm))	1.750 (44.4)	1.750 (44.4)	1.750 (44.4)	0.75 (19.0)	0.625 (15.8)
Weight (lb/ft / (kg/m))	0.093 (0.67)	0.093 (0.67)	0.090 (0.65)	0.026 (0.18)	0.018 (0.13)
Operating Temperature Range	-65°C to +150°C				

	MG-300	MG-300S	MG-200	MG-160	MG-130
Electrical Specifications					
Velocity of Propagation (Nom.)	81%	81%	80%	80%	80%
Time Delay (nS/ft / (nS/m), Nom.)	1.27 (4.16)	1.27 (4.16)	1.27 (4.16)	1.46 (4.79)	1.25 (4.10)
Impedance (Ohms, Nom.)	50	50	50	50	50
Capacitance (pF/ft / (pF/m), Nom.)	24.75 (81.2)	24.75 (81.2)	25.0 (82.0)	25.4 (83.3)	25.4 (83.3)
Shielding Effectiveness (dB)	90	90	90	90	90

	MG-300	MG-300S	MG-200	MG-160	MG-130
Attenuation: dB / 100ft (100m) (+25°C ambient)					
150 MHz	1.3 (4.2)	1.7 (5.5)	2.3 (7.54)	3.7 (12.1)	4.3 (14.1)
400 MHz	2.7 (8.85)	3.5 (11.4)	4.6 (15.0)	7.4 (24.2)	8.7 (28.5)
1000 MHz	4.3 (14.1)	5.6 (18.3)	7.4 (24.2)	11.8 (38.7)	13.8 (45.2)
3000 MHz	7.6 (24.9)	9.8 (32.1)	12.9 (42.3)	20.6 (67.5)	24.0 (78.7)
8000 MHz	12.9 (42.3)	16.4 (53.8)	21.5 (70.5)	34.1 (111.8)	39.8 (130.5)
10000 MHz	14.5 (47.5)	18.5 (60.6)	24.2 (79.3)	38.3 (125.6)	44.6 (146.3)
12000 MHz	16.0 (52.4)	20.4 (66.9)	26.6 (87.2)	42.1 (138.1)	49.1 (161.0)
13500 MHz	17.1 (56.1)	21.8 (71.5)	28.4 (93.1)	44.7 (146.6)	52.2 (171.2)
18000 MHz	20.1 (65.9)	25.5 (83.6)	33.1 (108.5)	52.0 (170.6)	60.6 (198.9)
30000 MHz	-	-	-	68.1 (223.4)	79.4 (260.4)
40000 MHz	-	-	-	79.5 (260.8)	92.5 (303.5)
50000 MHz	-	-	-	-	104.3 (342.2)



System Attachments

RF Filters

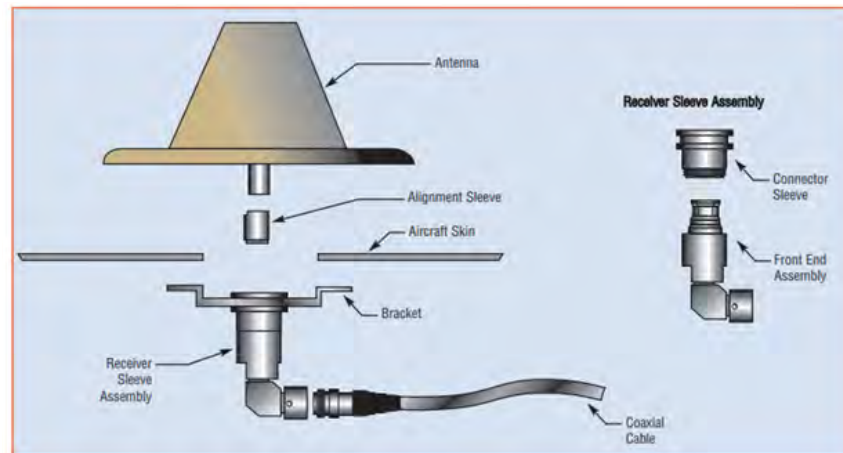
Manage interference troubleshooting with ease with Times Microwave bandpass and bandgap filters. Designed to integrate directly into TMS connectors, these RF filters are readily field- or line-installable to resolve antenna interferences. RF filters are available to address common conflicts, and custom filters are available.

Blind Mate Antennas

The Blind Mate Antenna, a unique product available only from Times Microwave Systems, enables design engineers to convert almost all existing platform Avionic Antennas into Blind Mate "plug-in and forget" quick release antennas, which can be quickly installed and removed from platforms without having to connect or disconnect the coaxial cable. By simply adding a screw-on alignment sleeve, an existing antenna (Blades, Spirals, multi-connector antennas, etc.) is converted to a plug-in device.

Key Features

- Occupies less space — antennas mountable in areas previously thought impossible, since space is not needed behind the antenna for connecting/disconnecting the interconnecting coaxial cable assembly.
- Eliminates service loops and lockwire requirements — cables remain mounted to brackets even without antenna installed
- Decreases coaxial cable damage — cables no longer exposed during servicing



Bulkhead Pressure Feedthroughs

For through-hull coaxial cable runs with tight loss budgets, Times Microwave bulkhead pressure feedthroughs eliminate the insertion losses created by a pressure feed-through connector. The TMS design uses a gland around the jacket to enable a single continuous cable through the hull while maintaining an aviation-qualified pressure seal.

Custom Products

TMS' catalog cables are only a starting point: our in-house engineering and manufacturing capabilities enable Times Microwave to deliver RF products that meet the most demanding and unusual aviation requirements. Our broad industry experience positions us to deliver innovative solutions to the civil aviation market taking advantage of the latest production technologies and materials.

Most importantly, as a manufacturer with fully integrated design, production, assembly and testing capabilities, Times Microwave can deliver RF interconnect solutions from conception through flight testing and production.

Design and Engineering

TMS Applications Engineers have centuries of combined experience developing RF interconnects for high-reliability environments. We work with the customer to characterize trade spaces, sketch engineering drawings or STEP files, and manufacture prototypes. With connector and cable design engineers sitting side-by-side, we can ensure effective integration at the cable/connector interface, optimizing insertion loss and VSWR.

Our diverse array of manufacturing technologies enables TMS engineers to specify the broadest range of RF cable and connector constructions worldwide. We leverage these abilities to generate custom products that simultaneously meet multiple challenging electrical, mechanical, and physical requirements.

Production

With manufacturing and assembly in Wallingford, CT; Mesa, AZ; West Palm Beach, FL; and Shanghai, China, TMS can respond to demand quickly and globally. Our variety of manufacturing tools enable customers to specify a wide range of materials and constructions.

Qualification

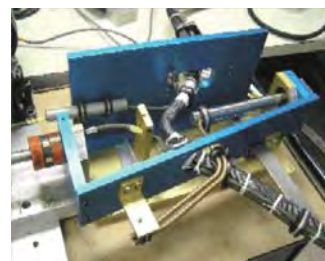
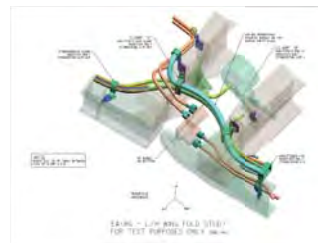
Full testing laboratories in Wallingford and Shanghai enable TMS to support customer certification campaigns as well as quickly troubleshoot maintenance issues. Times also maintains AS9100 D and ISO9001:2005 registrations.

Supply Chain Management and AOG Support

Our experienced sales and logistics teams respond quickly to changing customer needs and ensure that quality products are in the right place at the right time. Through our global network of distribution partners, Times can support custom supply chain solutions as well as position materials to resolve critical AOG situations.

Getting Started

To get more information about our custom product capabilities or to get started on your next project, contact your Times Microwave Regional Sales Manager.



MISSION

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

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

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



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