CABLE ASSEMBLIES

EMERSON
Network Power

Midwest Microwave
Connectivity Solutions

Emerson Network Power Connectivity Solutions has a wide range of cable assemblies and connectors suited for RF, Microwave and Fiber Optic signal transmission. Connectivity Solutions is a vertically integrated supplier of custom, fixed length and semi-rigid cable assemblies from DC to 50 GHz. Our product lines deliver custom-engineered products and solutions to satisfy the most demanding and complex requirements.

AIM-Cambridge
Connectivity Solutions

AIM-Cambridge has a universal line of products that offer cost effective, high quality solutions for connectivity. Our connectors are available in BNC, Type N, F Type, RCA, UHF, Mini-UHF, TNC, D-Sub and Modular Plugs for Data/Telecom applications. In addition, we stock a wide variety of cables for A/V, SATV, CATV, computer and LAN applications, as well as a complete line of termination tools and structured cabling products. AIM-Cambridge promises that its product will provide you with unmatched consistency, quality, reliability and ease of use.

Johnson
Connectivity Solutions

Johnson designs and manufactures an industry leading line of RF coaxial connectors and adapters, which are available in both 50 and 75 ohm versions. Johnson connectors are designed to provide the highest quality data transmission for audio, video and data applications. The Johnson line of products can address frequency ranges from DC to 46GHz and all sizes from Ultra-miniature interfaces (UMC), Micro-miniature, (MCX, MMCX, SMP), Subminiature (SMA, SMB, SMK, kwiQMAte™), Medium connectors (Type N connectors) through to large connectors (DIN7/16). The breadth of products available within the Johnson range includes board and cable mount connectors as well as semi-rigid, conformable, and flexible RF coaxial cables.

Midwest Microwave
Connectivity Solutions

Midwest Microwave manufacturers passive coaxial microwave components that are known for their precision performance and high quality that meets the precise requirements of the RF/Microwave industry. Our broad product portfolio includes: Attenuators, Precision Adapters, Terminations, DC Blocks, Power Dividers, Couplers, Equalizers, Phase Shifters, Connectors, Custom Cable Assemblies and Test Cables that are designed and manufactured for both military and commercial applications.

Semflex
Connectivity Solutions

Semflex designs and manufactures low loss, flexible, microwave coaxial cable and custom cable assemblies for the military/aerospace, commercial OEM and test instrumentation markets. Semflex offers cables ranging from DC to 50 GHz, available with ultra low insertion loss, power ratings up to 21 KW, and available with all popular connectors.

Stratos
Connectivity Solutions

Stratos optical connectivity products is globally recognized as highly reliable, cost-effective, and provides optical connectivity solutions that are virtually immune to dust, mud, oil, water, and other contaminants.

Our expanded beam connectivity products are ideal for harsh environment applications in the broadcast, industrial, petrochemical and military/aerospace markets where high reliability, low maintenance and quick serviceability are critical requirements. Our optical active products are used mainly in harsh environment applications where high speed/high reliable performance is critical. The actives product line includes optical transceivers, optical media converters and custom devices tailored to your application.

Trompeter
Connectivity Solutions

Trompeter is recognized as a global leader in delivering best in class RF connectivity products. The Trompeter line of patch jacks, RF connectors, cable assemblies, HDTV digital technology and DS3 connectivity solutions is unrivalled. Our mission is to provide products that continually deliver the highest quality signal integrity for the most demanding applications in Telecom, Central Office, Broadcast, Aerospace, and Instrumentation markets worldwide. Our extensive line of cost-effective products are rigorously designed and tested to provide the critically engineered solutions necessary to enhance the end-user's overall experience.

Vitelec
Connectivity Solutions

Vitelec provides a comprehensive range of RF coaxial interconnect products and cable assemblies. The company has a long established reputation for offering quality and innovation with a wide range of both standard and custom designed products for the electronic and communication industries.

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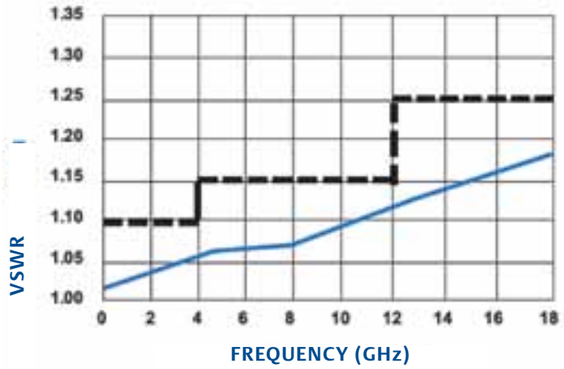
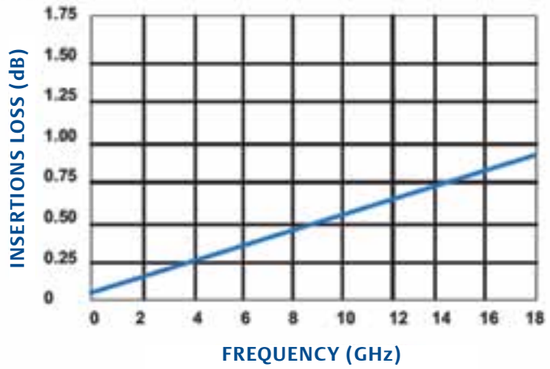
Cable Assemblies are a necessary and important part of a microwave system providing the coaxial transmission lines through which the signals received or transmitted by a system pass as they travel from or to their respective origins or destinations. Insertion Loss in these transmission lines is a very serious consideration as excessive loss can cause the system to operate inefficiently or not at all. The Midwest Microwave product line from Emerson Connectivity Solutions offers this complete product line of Microwave Coaxial Cable Assemblies, ruggedly designed to provide highly reliable, low loss, phase and temperature stable signal transmission over very broad frequency ranges. These Cable Assemblies are available in a wide selection of cable construction types, each suited to the particular requirements of a system. Simple flexible cable assemblies are available from standard MIL-C-17 cable for many system requirements as well as semi-flexible and semi-rigid cable assemblies. High reliability, low loss, low VSWR, phase matched, and phase stable cable assemblies with repeatable performance over temperature are the top of the range of products offered.

Insertion and return loss test data can be supplied with each cable if desired. Cable assemblies using Emerson Connectivity's standard catalog cable assembled to custom lengths are available in very short delivery schedules. Special assemblies can be custom designed by our engineering staff to accomodate unique system needs. All Midwest Cable Assemblies are completely manufactured in house and are 100% tested to insure only the highest quality performance whether for military or space use or for commercial cellular or personal communications applications.

Typical VSWR and Insertion Loss Performance

ONE FOOT CABLE ASSEMBLY





Definition of Parameters

Impedance

The characteristic impedance equation for a coaxial transmission line is expressed as follows:

$$\textbf{Impedance} = Z_O = \frac{138.06}{\sqrt{\varepsilon}} \log_{10} D/d$$

where: D = diameter of outer conductor

d = diameter of center conductor

ε = dielectric constant of insulation material

If the center conductor diameter of a cable is increased to reduce loss, the outer conductor diameter can only be held in check if the dielectric constant of the insulation between the inner and outer conductors is reduced. It is clear then that a lower dielectric constant will yield a smaller diameter cable for an increased center conductor diameter of a lower loss cable of constant impedance.

Frequency

The highest frequency of operation by a cable assembly is determinied by the "TEM" mode frequency (Transverse Electromagnetic Mode) or the frequency at which the electromagnetic field departs from the "TEM" mode. This upper frequency mode limitation is controlled by the transmission line size which means that the higher the frequency of operation desired, the smaller in diameter the coaxial line size must be, for a given dielectric constant of the dielectric insulation between the inner and outer conductor of the cable. The requirement for lower insertion loss in a coaxial cable is unfortunately a driving force toward a larger physical size of the cable (for a given dielectric constant of the insulation), which improves the ability of the cable to dissipate the heat generated by the microwave power being transmitted through it. These opposing forces cause a classic compromise to be made between higher frequency operation and loss characteristics unless a lower dielectric constant insulation material can be used. Physical size and weight restrictions of most microwave systems as well as the requirement for higher frequency operation provide the impetus for smaller diameter cable assemblies that are low in insertion loss.

Insertion Loss

Insertion loss in a cable assembly is the result of a combination of several types of losses; attenuation loss (dissipative) or loss attributed to the center conductor size or material, dielectric losses, shield skin effect and shield leakage; and Impedance mismatch loss (reflective) , most often referred to as VSWR losses. Mismatch loss, identified with high VSWR measurement is often caused by the attachment of coaxial connectors to the cable. The design of these connectors and their compatibility with the coaxial cable being used are important considerations when attempting to attain loss efficient performance of a

cable assembly. In well shielded cable such as semi-rigid or multiple shield flexible cable, skin effect and shield leakage losses are very low but center conductor skin effect losses are significant and dielectric losses increase with increasing signal frequency. For this reason a low dielectric constant insulation serves two important purposes; a larger diameter center conductor may be used for a given diameter cable thereby lowering the loss per unit length as well as the capacitance of the cable; and higher frequency of operation can be achieved because the line size can be kept small while the loss requirements are met.

VSWR

Reflections due to impedance mismatches and other discontinuities in a coaxial cable assembly are most often introduced through the attachment of the connectors to the cable. The proper design of the connector itself as well as the technique used to attach it to the cable are important factors in attaining low VSWR and low insertion loss.

Wave Propogation Velocity

The wave propogation velocity is the measure of the speed that an electromagnetic signal will travel through a given dielectric material as compared to the speed of light through an air dielectric. It is usually expressed in percent (%), 100% being equal to the speed of light through air. As can be seen from the formula below, the propogation velocity increases as the dielectric constant ( ) decreases.

$$\textbf{Velocity of Propogation} = V = \frac{100}{\sqrt{\varepsilon}} = \% \; v_o$$

where: v_o = Speed of Light through air

ε = Dielectric Constant of material

Electrical Length

The electrical length, sometimes referred to as phase length, of a coaxial cable assembly is determined by the number of wavelengths in degrees or radians that the physical length of the cable assembly, (including connectors), contains when measured at a specific frequency. This property is a function of the dielectric constant of the insulation material used between the inner and outer conductor of the cable and the wave propogation velocity attained with that dielectric. This relationship is shown in the expression below.

$$\text{Wavelength} = \lambda = \frac{v_o}{f\sqrt{\varepsilon}}$$

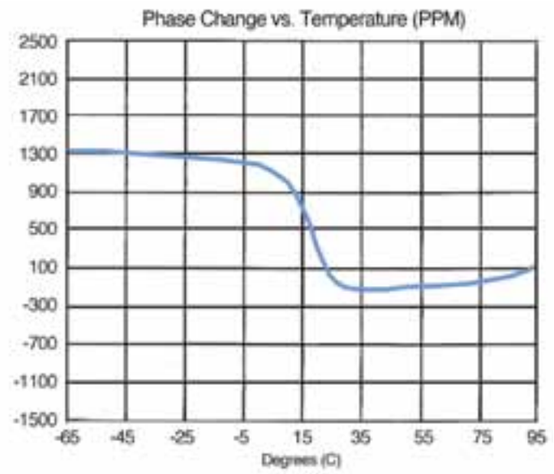
where: v_o = speed of light through air

f = frequency of signal

ε = dielectric constant of insulation material

Phase Stability with Temperature

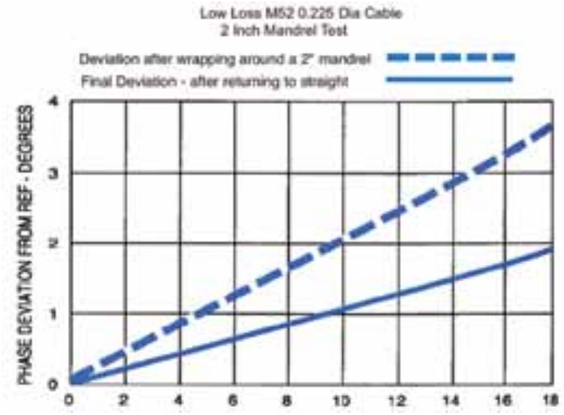
The ability of a cable assembly to maintain its phase relationship over temperature variations is enhanced when low dielectric constant material is used because less mass is present in the dielectric which provides a lower coefficient of thermal expansion thereby relieving the problem of physical length and phase changes over temperature. In addition the cable can be pre-conditioned before assembly by temperature cycling it repeatedly through the temperature range of desired operation such that it becomes stable when exposed to those same temperature variations.



Phase Stability with Flexure

The ability of a cable assembly to maintain its phase length with flexure is the result of mechanical techniques used in providing the shielding which controlls the reflections and other impedance discontinuities that cause phase variations and can also be enhanced by pre-conditioning the cable before assembly by subjecting it to repeated flexing such that it becomes stress relieved and is not as effected by flexure. The ability of a cable assembly to remain stable with flexure can be demonstrated by making four phase measurements of the cable assembly; the first when initially measuring the phase of the assembly in a straight configuration; the second after wrapping it one full turn clockwise around a 2 inch mandrel and measuring its phase length in that configuration; the third after wrapping it one full turn counterclockwise around the mandrel; and the fourth after returning to a straight configuration. The data is then compared to determine the amount of deviation that occurred between states to evaluate the phase stability of the assembly.

Phase Stability with Flexure



Shielding Effectiveness

The solid sheath shield of semi-rigid cable is by far the most efficient shielding method yet attained. In order to accomplish effective shielding for flexible cable that approaches this efficiency, various techniques using combinations of helically wound flat foil and flat and round braid have been developed. These techniques have been largely successful in providing excellent shielding for flexible cable that exceeds -100 dB. The requirement of MIL-T-81490 (using the cavity technique) is -90 dB through the frequency range of 2.0-18.0 GHz.

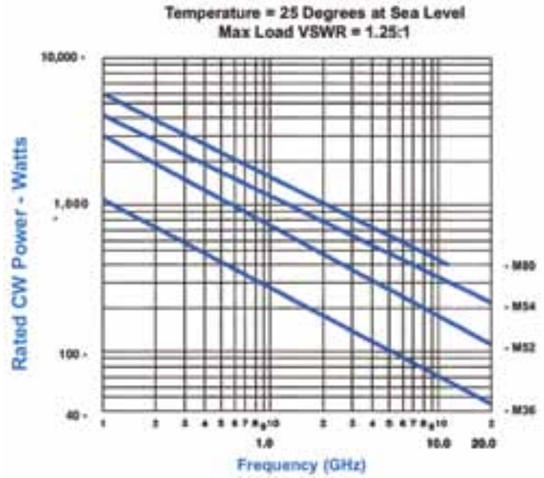
Vibration and Shock

The ability of a cable assembly to withstand the abusive environment of high vibration and shock is very important in all types of microwave systems. Semi-rigid cable assemblies sometimes experience cracking of the solder joints during exposure to extreme shock and vibration and under these conditions flexible cable assemblies should be employed.

Power

The ability of a cable assembly to transmit power in a system is primarily a function of temperature. Heat generation is directly related to the resistive losses caused by the center conductor resistance and the VSWR resulting from discontinuities and impedance mismatches. In most cases the limiting factor is the connectors being used and the integrity of the interface between connector and cable, and not the cable itself. When determining the power performance of a cable assembly, the connector should be a key item that should be examined carefully for power performance characteristics.

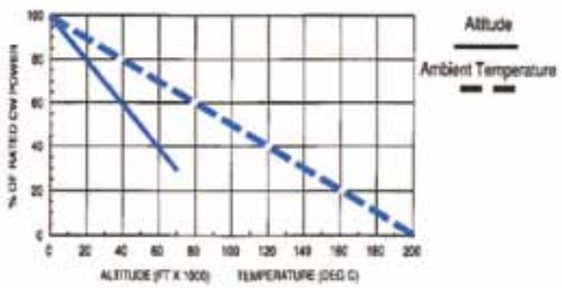
CW Power



Temperature and Altitude

The graph shown above describes the approximate power rating of two of the low loss cables, at 25°C ambient at sea level and an assumed maximum load VSWR of 1.25:1. As temperature and altitude increase, a percentage derating factors must be applied. The graphical illustration shown below provides approximate percentage derating factors that can be applied for other temperatures and altitudes.

Altitude and Temperature % Derating



Humidity and Moisture Resistance

Microwave coaxial cable assemblies must be capable of withstanding exposure to moisture and humidity. Moisture absorbtion due to variations in temperature can affect VSWR, insertion loss, insulation resistance, and dielectric withstanding voltage. Testing to MIL-STD-202 and MIL-STD-810 will assure that the assemblies are capable of meeting the required environmental specifications.

Weight

System weight is always a factor that must be considered, especially in an airborne microwave system. Low dielectric constant cable can improve the loss performance by 6 to 10% over larger and heavier cable and will simultaneously provide as much as a 50% weight savings.

Ruggedization

There are many different environmental situations that flexible cable assemblies must be able to cope with in the wide variety of microwave systems that they are used in. Some of them require more physical protection than others. Surprisingly the laboratory environment is almost as hostile as an airport ramp because when used in test systems the cable assemblies are engaged and disengaged many times over and are bent, stretched and crushed as much or more than they would be in most systems. There are four basic types of ruggedization that are provided to protect the cable assemblies from external damage during use; the first is the “Standard” type that simply provides a thick extruded FEP jacket over the outer braid that suffices for most applications and it is what normally is supplied; an optional additional protective polyolefin jacket over the FEP jacket falls within this level of protection and is called “J” type; another is called “A” type for “Armored” which provides an additional stainless steel conduit type jacket assembled over the FEP jacket to further protect the cable from pinching and crushing when used in extremely hostile field applications; another is called “B” type that uses a ‘’Thermoflex” sheath over the FEP jacket for situations that call for severe abrasion protection where possible continual rubbing against other objects is likely; the fourth type is called “C” type for “Crushproof” and in this case a stainless steel spring is provided over the FEP jacket covered by polyolefin shrink sleeving and offers moderate crush protection.

Electrically Matched Cable Assembly Sets

Cable assemblies are sometimes required to be matched electrically. Matching can also be required in more than just one characteristic. They can be matched for either phase, insertion loss, or time delay and in some instances they can be matched in any combiation of all three characteristics. In addition cable assemblies can be “Relatively” matched to each other using one of the assemblies as a comparitive standard or “Absolutely” matched to a specific specification with specific controlling tolerances for each characteristic. In all cases the cable assemblies must use the same type cable and the exact same connectors in order to conform.

General Specifications

General

To define and specify the cable assembly required to meet a particular specification and to allow it to be manufactured efficiently and economically, the user and the manufacturer must be in agreement with each other on exactly what the parameters of the specification are and what limitations exist such that the resulting product will satisfy the requirements of the user and the product will in fact be able to be produced efficiently and economically. Midwest Microwave maintains an experienced staff of engineers that are ready and willing to assist in this process.

Cable Type

In selecting the type of cable to be used on a cable assembly, the user should carefully evaluate the requirements of the system that the assemblies are going to be used in. Operating frequency, insertion loss, VSWR, phase, power, connector type, physical space and weight, and all environmental exposures should be considered. Midwest Microwave offers a wide variety of cable types and ruggedization options that were designed to fit the needs of most microwave systems. The section on cable specifications describe in detail the different cable choices available.

Length Measurement and Tolerances

The overall length of a cable assembly is measured from connector end to connector end, however phase length measurements are usually from connector interface reference plane to connector interface reference plane in the case of straight connectors and in the case where a right angle connector is used, the connector center pin centerline is the measurement point. Standard length tolerances are as listed below:

LENGTH TOLERANCES

Nominal Length	Tolerance
Up to 10 Feet	±0.250 Inch
10 to 20 Feet	±0.500 Inch
20 to 30 Feet	±1.0 Inch
30 to 40 Feet	±1.5 Inch
40 to 50 Feet	±2.0 Inch
> 50 Feet	Consult Factory

NOTE: Tighter tolerances are available for an additional cost.

Connector Selection

The connectors selected should be compatible with the cable size selected so that the resulting performance of the assembly will be acceptable and will not degrade system performance. The connectors selected are most often controlled by the compatibility requirements of the system and the components used in it, however this should be kept in mind when selecting cable so that the resulting performance/cost ratio is reasonable.

Connector Orientation

For semi-rigid cable assemblies and flexible cable assemblies where “D” hole mounting connectors (and or right angle connectors) are used, the relative angular orientation must be specified such that the resulting assembly will mount and mate satisfactorily in the system. Standard tolerance for angular orientation is ± 20° for flexible assemblies and ± 5° for semi-rigid assemblies.

Cable Assembly Insertion Loss

The insertion loss of the total assembly including the connectors is an important consideration when specifying a cable assembly and it must take into consideration the operating frequency, cable size and loss characteristics, length of the cable assembly and the type and configuration of the connectors to be used. The insertion loss curves for each type of cable available are shown in the respective cable specification section. To determine the anticipated insertion loss of a cable assembly, add the loss for the length of cable used, (per the charts in the cable specification section), to the estimated loss for each connector per the table below and then add the loss attributable to VSWR (mismatch loss) as shown in table below.

TYPICAL CONNECTOR INSERTION LOSS

Frequency Range (GHz)	SMA Straight Connector	SMA Right Angle Connector	Type N, TNC and 7mm Connectors
2.0	0.03	0.08	0.05
4.0	0.05	0.10	0.08
6.0	0.06	0.12	0.10
8.0	0.07	0.14	0.11
10.0	0.08	0.16	0.13
12.0	0.09	0.18	0.14
14.0	0.10	0.20	0.15
16.0	0.11	0.22	0.16
18.0	0.12	0.25	0.18
20.0	0.13	N/A	N/A
22.0	0.14	N/A	N/A
24.0	0.15	N/A	N/A
26.5	0.16	N/A	N/A

NOTE: Insertion Loss is for each connector.

TYPICAL MISMATCH INSERTION LOSS

VSWR	Insertion Loss
1.20 : 1	0.04
1.25 : 1	0.06
1.30 : 1	0.07
1.35 : 1	0.10
1.40 : 1	0.12
1.45 : 1	0.50
1.50 : 1	0.18

NOTE: Typical VSWR shown is for SMA connectors only.

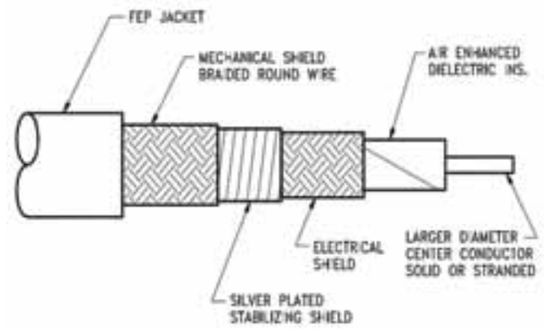
Cable Assembly VSWR

The VSWR of a cable assembly depends on the cable, connectors, signal frequency, assembly length, the termination used, and the test method and equipment used to measure it. The following table may be used as a guide in specifying VSWR:

TYPICAL CONNECTOR ASSEMBLY VSWR

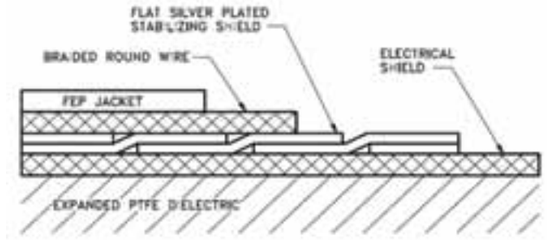
Frequency Range (GHz)	Cable Assembly with Straight Connector	Cable Assembly with two angle Connector	Cable Assembly with mixed Connectors
DC - 2	1.10	1.20	1.20
2 - 4	1.10	1.25	1.25
4 - 8	1.15	1.35	1.35
8 - 12	1.20	1.45	1.45
12 - 16	1.25	1.45	1.45
16 - 18	1.25	1.50	1.45
18 - 26	1.35	(N/A)	(N/A)

Low Loss Cable Construction



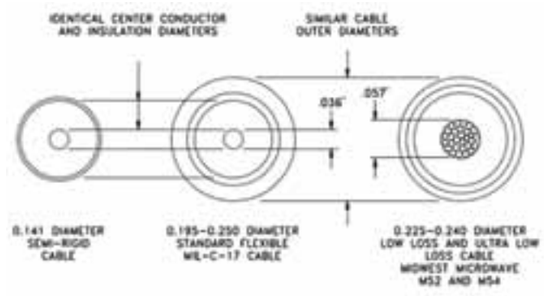
Low Loss Cable Design

Midwest Microwave Low Loss Cable is designed to take advantage of air-enhanced PTFE dielectrics that lower the dielectric constant and allow a flexible, phase and temperature stable high performance coaxial cable to be made available to produce high quality cable assemblies with excellent performance characteristics. In addition substantial size and weight savings are also realized because of the use of the lower dielectric constant material. Center conductors are available in both solid or stranded form depending on whether loss or flexibility is of primary concern.



Shielding Technique

The unique and efficient shield construction technique used in Midwest Microwave cable is a key reason for the excellent phase and temperature stability that it is able to attain. This is accomplished by providing a unique flat shield over the dielectric which is then further stabilized by another sheath which not only provides additional leakage protection but adds considerably to the mechanical and electrical stability characteristics of the cable. Following this, another layer of round braided shield is provided adding strength and further leakage protection. The final cover is the FEP jacket which provides resiliency as well as moisture protection.



Center Conductor Size

The largest and single most effective deterrent to cable loss is the introduction of a larger diameter for the center conductor. The more surface area per unit length that a center conductor can provide, the lower the loss of the coaxial cable. In order to use a larger center conductor, but still retain the outer diameter, lower dielectric contsant insulation must be used. Flexibility and temperature stability is enhanced by the use of the lower density dielectric. Ultra low loss is attained by using a larger diameter solid center conductor while low loss with improved flexibility is accomplished by using a larger diameter stranded center conductor.

Ruggedization Cable Construction

Ruggedizaton for Extreme Environments

- **Standard Tough FEP Jacket**
- **Crush Proof Protection**
- **Abrasion Proof Protection**
- **Armored Protection**

The Midwest Microwave product line from Emerson Connectivity Solutions offers three types of additional ruggedization that can be added over the standard FEP cable jacket. Each type is designed to provide the maximum protection for the environmental situation that may be encountered. There is no degradation in performance when ruggedization of any level is selected and strain relief boots are provided on all assemblies.

Type S = **Standard FEP Jacket**

Type J = **Added Polyolefin Jacket over Standard FEP Jacket**

The tough, resilient extruded FEP jacket is Standard on all Midwest Microwave Cable Assemblies. It provides an excellent moisture seal and stands up to most environments. It is resistant to abrasion and most solvents. It provides the primary covering of the mechanical shield under all of the additional ruggedization schemes.

The Type J ruggedization is the provision of an additional Polyolefin shrink jacket over the standard FEP jacket for additional protection from wear and abrasion.

Type A = **Armored Ruggedization**

Cable Assembly Armor consists of stainless steel conduit placed over the standard FEP jacket that protects the assembly from severe pinching and crushing of up to 300 lbs. per linear inch. A polyolefin heat shrink jacket is provided covering the armor. This type of harsh environmental protection is often required on flight lines and on board naval ships where the assemblies are very exposed and are apt to have vehicles ride over them.

Type B = **Thermoflex Abrasion Ruggedization**

This very tough abrasion proof outer covering provides extremely good protection to cable assemblies that are exposed to constant abrasion from rubbing repeatedly against other objects or moving or translating mechanisms. It consists of a Thermoflex sheath placed over the standard FEP jacket with standard strain-relief boots. Thermoflex is a high temperature (650°C) abrasion proof material.

Type C = **Crushproof Ruggedization**

Cable assemblies are often subjected to moderately severe treatment, even in the laboratory where reliability and repeatability is crucial. This Crushproof type of ruggedization consists of a stainless steel spring placed over the standard FEP jacket and covered with a polyolefin shrink jacket. Strain relief boots are also applied and this combination will withstand 100 lbs. per linear inch of abuse.

Defining Low Loss and Other Cable Assemblies

Low Loss – High Performance

- **Thirteen Low Loss Cable options**
- **Wide Connector Selection**
- **Phase Matching available**
- **Crush Proof Armored Protection options**

The Midwest Microwave product line from Emerson Connectivity Solutions offers thirteen types of low loss and ultra low loss cables as well as improved MIL-C-17 flexible cable and several types of conformable and semi-rigid cable. Solid center conductor types offering the lowest loss capability and stranded center conductor types offering a well balanced combination of low loss and flexibility. Most of the choices allow additional ruggedization that can be added over the standard cable jacket.

MODEL NUMBER DESIGNATION

CSY- □□□□–□□–□□□–□□

RUGGEDIZATION AND OTHER SPECIAL DESIGNATIONS

S = Standard Cable Jacket
A = Armored
B = Thermoflex Abrasion Proof
C = Crushproof
M = Special Cable Markers required
H = Hybrid combination of ruggedization types
J = Added polyolefin shrink jacket over standard jacket

UNIT OF MEASURE

I = Inches
F = Feet
M = Meters
P = Phase Matched Assembly
S = Special Requirements Apply* (see cust dwg.)
H = Add 0.5 inches to length (length is in. only)
W = Millimeters

LENGTH OF CABLE ASSEMBLY

(Alpha-Numeric coded for formed and special requirements)

CABLE TYPE

Low Loss Type 36, 44, 52, 60, 80, 90, or 100 for stranded center conductor
Ultra-Low-Loss Type 38, 46, 54, 62, 82, or 92 for solid center conductor

CONNECTOR – J2

SM = SMA male
SP = SMA panel mount female
3M = 3.5 mm male
TF = TNC female
NM = Type N male plug
7M = 7mm connector

CONNECTOR – J1

SA = SMA right angle male - cube type
SS = SMA right angle male - swept type
MF = BMA Blind Mate female plug
TP = TNC panel mounted female
CM = S C male plug
BM = BNC male plug

See Connector Selection pages for complete designation list.

BASIC CABLE ASSEMBLY PRODUCT LINE PREFIX

LOW LOSS CABLE ASSEMBLY PERFORMANCE SPECIFICATIONS

Insertion Loss vs Flexure ..... < ± .1 dB/Ft	Phase Matching ..... ± 1.0 o per GHz
Insertion Loss vs Temperature ..... 0.5% per °C	Phase Tracking ..... ± 0.1 o per GHz
Insertion Loss Matching ..... ± 0.2 dB @ 18 GHz	Phase Stability vs Flexure ..... < ± 0.1% per GHz per Ft.
Insertion Loss Fine Grain Variation ..... < .1 dB per 50 MHz	Phase Stability vs Temperature ..... < 25 ppm per °C

Cable Insertion Loss per Foot

Freq. (Ghz)	M-36	M-38	M-44	M-46	M-52	M-54	M-60	M-62	M-80	M-82	M-90	M-92	M-100
0.5	0.13	0.11	0.09	0.09	0.06	0.06	0.03	0.03	0.04	0.04	0.04	0.03	0.02
1.0	0.19	0.16	0.13	0.13	0.09	0.08	0.06	0.05	0.06	0.05	0.05	0.04	0.04
2.0	0.27	0.23	0.18	0.17	0.12	0.11	0.10	0.08	0.09	0.08	0.08	0.06	0.05
3.0	0.33	0.28	0.23	0.22	0.15	0.14	0.12	0.10	0.11	0.10	0.10	0.07	0.07
4.0	0.38	0.33	0.26	0.25	0.18	0.17	0.14	0.12	0.12	0.11	0.11	0.09	0.08
5.0	0.43	0.37	0.30	0.28	0.20	0.19	0.16	0.14	0.14	0.13	0.13	0.10	0.09
6.0	0.48	0.41	0.33	0.31	0.22	0.21	0.17	0.16	0.16	0.14	0.14	0.11	0.10
7.0	0.52	0.44	0.35	0.34	0.24	0.22	0.18	0.17	0.17	0.15	0.15	0.12	0.11
8.0	0.56	0.48	0.38	0.36	0.26	0.24	0.19	0.18	0.18	0.17	0.17	0.13	0.12
9.0	0.59	0.51	0.41	0.39	0.28	0.26	0.20	0.19	0.20	0.18	0.18	0.14	0.13
10.0	0.63	0.54	0.43	0.41	0.30	0.27	0.21	0.20	0.21	0.19	0.19	0.15	0.14
11.0	0.66	0.57	0.45	0.43	0.31	0.29	0.22	0.21	0.22	0.20	0.20	0.16	
12.0	0.69	0.60	0.47	0.45	0.33	0.30	0.23	0.22	0.23	0.21	0.21	0.16	
13.0	0.72	0.63	0.50	0.48	0.34	0.32	0.24	0.23	0.24	0.22	0.22		
14.0	0.76	0.65	0.52	0.49	0.36	0.33	0.25	0.24	0.25	0.23	0.23		
15.0	0.78	0.68	0.54	0.51	0.37	0.34	0.26	0.25	0.26	0.24	0.24		
16.0	0.81	0.70	0.55	0.53	0.39	0.36	0.28	0.26	0.27	0.25	0.25		
17.0	0.84	0.73	0.57	0.55	0.40	0.37	0.29	0.27	0.28	0.26			
18.0	0.87	0.75	0.59	0.57	0.41	0.38	0.31	0.28	0.29	0.27			
19.0	0.90	0.78	0.61	0.59	0.43	0.40	0.32	0.29					
20.0	0.92	0.80	0.63	0.60	0.44	0.41							
21.0	0.95	0.82	0.65	0.62	0.45	0.42							
22.0	0.97	0.84	0.66	0.64	0.46	0.43							
23.0	1.00	0.87	0.68	0.65	0.48	0.44							
24.0	1.02	0.89	0.70	0.67	0.49	0.45							
25.0	1.05	0.91	0.71	0.69	0.50	0.46							
26.0	1.07	0.93	0.73	0.70	0.51	0.47							
27.0	1.09	0.95	0.74	0.72	0.52	0.49							
28.0	1.12	0.97	0.76	0.73	0.54	0.50							
29.0	1.14	0.99	0.77	0.75									
30.0	1.16	1.01	0.79	0.76									
31.0	1.18	1.03	0.80	0.77									
32.0	1.20	1.05	0.82	0.79									
33.0	1.23	1.07	0.83	0.80									
34.0	1.25	1.09	0.85	0.82									
35.0	1.27	1.11	0.86	0.83									
36.0	1.29	1.13	0.88	0.84									
37.0	1.31	1.14	0.89	0.86									
38.0	1.33	1.16	0.90	0.87									
39.0	1.35	1.18	0.92	0.88									
40.0	1.37	1.20	0.93	0.90									
41.0	1.39	1.22											
42.0	1.41	1.23											
43.0	1.43	1.25											
44.0	1.45	1.27											
45.0	1.47	1.29											
46.0	1.49	1.30											
47.0	1.51	1.32											
48.0	1.53	1.34											
49.0	1.54	1.36											
50.0	1.56	1.37											

Maximum Performance Selection

- **Match Size and Loss Requirements**
- **DC - 50 GHz Frequency Performance**
- **Select Ruggedization Option**
- **SMA, BMA, 3.5mm,7mm, N, TNC, BNC**

The unique construction characteristics of this product line of Midwest Microwave low loss and ultra-low loss cables provides the highest stability available for loss, phase, VSWR, and time delay over temperature and flexure exposure. The high degree of performance linearity over the frequency spectrum makes them especially suited for cable assemblies with high reliability performance requiring phase, VSWR, and time delay matching. Cable with stranded center conductors are slightly more flexible than those with solid center conductors, however as can be seen from the specifications, the solid center conductor cables are slightly better in loss characteristics.

ULTRA-LOW CABLE SPECIFICATIONS

Midwest Cable No.	M-38	M-46	M-54	M-62	M-82	M-92
Impedance (Ohms)	50	50	50	50	50	50
Center Conductor Type	Solid	Solid	Solid	Solid	Solid	Solid
Outside Diameter - inches (mm)	0.125 (3.2)	0.160 (4.1)	0.205 (5.2)	0.290 (7.4)	0.305(7.8)	0.450 (11.4)
Frequency Cutoff (GHz)	55	40	28	19	18	12
Insertion Loss (dB)	See Chart	See Chart	See Chart	See Chart	See Chart	See Chart
CW Power (kW) @ 5 GHz	0.13	0.25	0.85	1.85	1.85	3.15
RF Leakage (dB) @ 5 GHz	-90	-90	-90	-90	-90	-90
Capacitance (pF/ft)	27	27	27	27	27	27
Velocity of Propogation (%)	75	76	76.5	76.5	76.5	76.5
Time Delay (nS/ft)	1.35	1.34	1.33	1.33	1.33	1.33
Temperature Range (°C)	-65 to+200	-65 to+200	-65 to+200	-65 to+200	-65 to+200	-65 to+200
Minimum Bend Radius (In.)	0.6	0.9	1.1	1.6	1.8	2.5
Weight (Lbs./Ft.)	0.02	0.04	0.05	0.08	0.09	0.20

LOW LOSS CABLE SPECIFICATIONS

Midwest Cable No.	M-36	M-44	M-52	M-60	M-80	M-90	M-100
Impedance (Ohms)	50	50	50	50	50	50	50
Center Conductor Type	Stranded	Stranded	Stranded	Stranded	Stranded	Stranded	Stranded
Outside Diameter - inches (mm)	0.125 (3.2)	0.160 (4.1)	0.205 (5.2)	0.290 (7.4)	0.305 (7.8)	0.350(8.9)	0.500(12.7)
Frequency Cutoff (GHz)	55	40	28	19	18	16.4	10.4
Insertion Loss (dB)	See Chart	See Chart	See Chart	See Chart	See Chart	See Chart	See Chart
CW Power (kW) @ 5 GHz	0.13	0.25	0.85	1.85	1.85	3.15	5.75
RF Leakage (dB) @ 5 GHz	-90	-90	-90	-90	-90	-90	-90
Capacitance (pF/ft)	27	27	27	27	27	27	27
Velocity of Propogation (%)	75%	76%	76.5%	76.5%	76.5%	76.5%	76.5%
Time Delay (nS/ft)	1.33	1.33	1.33	1.33	1.33	1.33	1.33
Temperature Range (°C)	-65 to+200	-65 to+200	-65 to+200	-65 to+200	-65 to+200	-65 to+200	-65 to+200
Minimum Bending Radius (In.)	0.5	0.8	1.0	1.5	1.7	2.0	2.8
Weight (Lbs./Ft.)	0.02	0.04	0.05	0.08	0.09	0.12	0.24

Materials and Finishes

Center Conductors - Silver-coated copper per ASTM-B-298 40 micro-inches min thick per MIL-C-17.
Electrical Shields - Silver-coated flat copper per IPC-FC-221 40 micro-inches thick min per MIL-C-17.
Mechanical Shields - Silver-coated copper per ASTM-B-298 40 micro-inches thick min per MIL-C-17.
Dielectric Core - Air-Enhanced poytetrafluoroethylene (PTFE), tape wrapped per MIL-C-17.
Jacket - Extruded fluorinated ethylene propoylene (FEP), per MIL-C-17, Type IX.
Armor - Stainless Steel per ASTM-A-582 and ASTM-A-484.

Low Loss Cable Characteristics

High Performance Cable Assemblies

- **Ultra-Low Insertion Loss**
- **DC - 26.5 GHz Performance**
- **Phase and Temperature Stable**
- **Highly Flexible**

The unique construction characteristics of this product line of Midwest Microwave low loss and ultra-low loss cables provides the highest stability available for loss, phase, VSWR, and time delay over temperature and flexure exposure. The high degree of linearity over the frequency spectrum makes them especially suited for cable assemblies with high reliability performance requiring phase, VSWR, and time delay matching.

Ultra Low Loss Cables – *Solid Center Conductor*

M-38
0.125 Dia

M-46
0.160 Dia

Designed to replace 0.141 semi-rigid cable. This cable is ideal for low loss applications where size, weight, and performance are critical criteria. These cable will operate up to 40 and 50 GHz respectively.

M-54
0.205 Dia

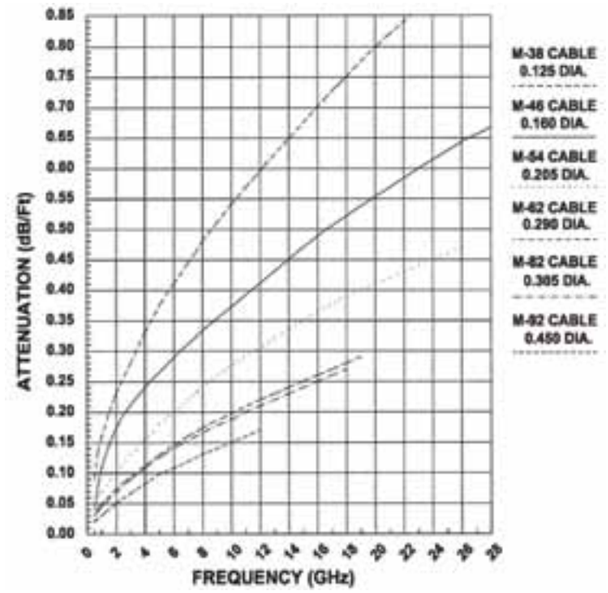
M-62
0.290 Dia

Designed for low loss applications where low loss is critical and high signal frequency is desired. An excellent balance of loss and size.

M-82
0.305 Dia

M-92
0.450 Dia

Designed for unsurpassed low loss with reasonable flexibility in a moderate diameter. These cables will operate to 12 and 18 GHz and exhibit extremely good phase stability characteristics.



Low Loss Cables – *Stranded Center Conductor*

M-36
0.125 Dia

M-44
0.160 Dia

Designed for small size, light weight high frequency applications where small size and low loss is a priority and high frequency ability is necessary. These cables are ideal to replace .141 semi-rigid cable.

M-52
0.205 Dia

M-60
0.290 Dia

Designed for applications where low loss is a priority and flexibility and phase stability is necessary. This cable is the optimum choice for loss, size, and weight considerations.

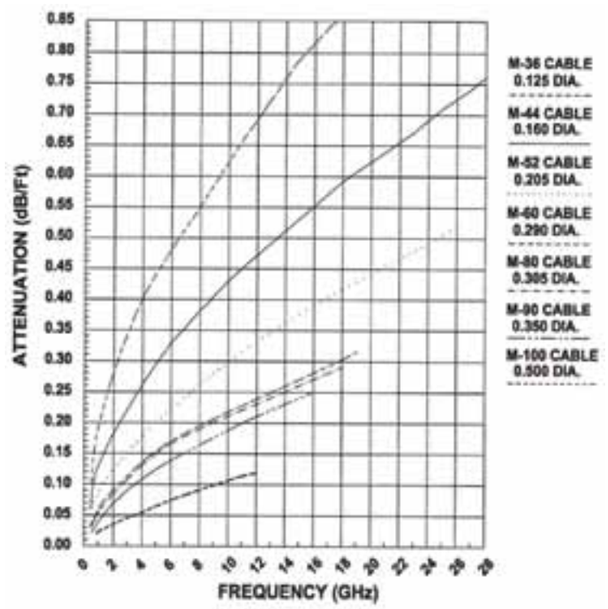
M-80
0.305 Dia

M-90
0.350 Dia

Designed for very low loss applications where a stable, relatively flexible cable is critical to the application.

M-100
0.500 Dia

Designed for very low loss applications up to 10.4 GHz where high power is anticipated.



Note: For detail cable specifications refer to page 11.

Improved MIL-C-17 Cable Characteristics

Improved MIL-C-17 Performance Cable

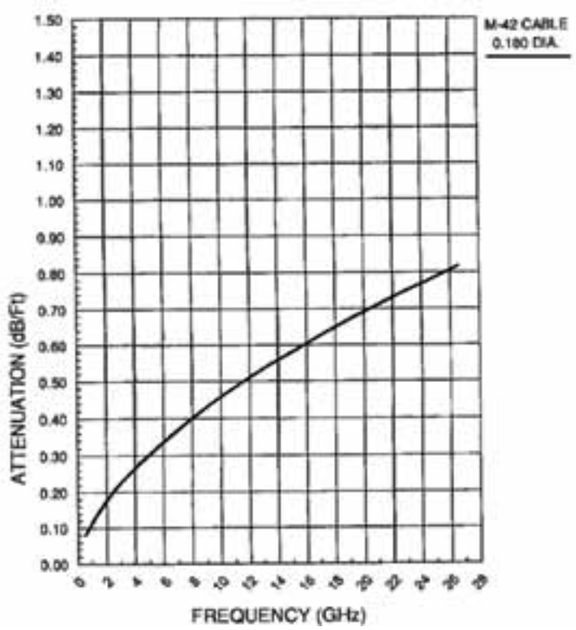
- **Lower Loss MIL-C-17 Cable Assemblies**
- **Improved VSWR Performance**
- **Improved Phase and Temperature Stability**
- **Excellent Cost / Performance Ratio**

The Midwest Microwave line from Emerson Connectivity Solutions, offers these improved versions of the more popular sizes of MIL-C-17 cables in the form of improved performance cable assemblies. By improving the quality of the basic construction of these extruded dielectric cables and carefully designing connectors that are closely compatible to them, a very high cost / performance ratio cable assembly has been achieved. Useable on many applications where the standard cables were not acceptable, these new improved versions allow the performance criteria to be met for a much more reasonable price than other higher cost options.

Improved SF142

M-42
0.180 Dia

Designed for moderate low loss applications where the cost/performance ratio is critical and high signal frequency is desired. A well balanced cable of loss vs size it is an improved version of SF142, a very popular cable in all types of systems both military and commercial.



Improved MIL-C-17 Cable Specifications

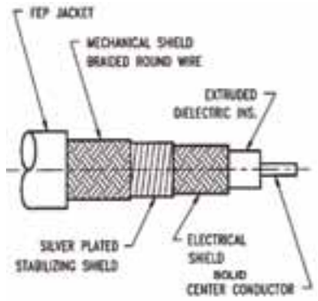
Improved Performance

- **Relative Low Loss for Low Cost**
- **Improved Stability**
- **DC - 26.5 GHz Frequency Performance**
- **SMA, BMA, 3.5mm,7mm, N, TNC, BNC**

The unique construction characteristics of this line of Midwest Microwave improved MIL-C-17 cables provide the highest stability available for this category of cable for loss, phase, VSWR, performance over temperature and flexure exposure. The high degree of performance over the frequency spectrum makes them particularly suited for lower cost cable assemblies with high reliability performance requiring phase and VSWR performance.

IMPROVED MIL-C-17 CABLE SPECIFICATIONS

Midwest Cable No. MIL-C-17 Designation	M-42 SF142
Impedance (Ohms)	50 ± 2 Ohms
Center Conductor Type	Solid
Outside Diameter - inches (mm)	0.180 (4.6)
Frequency Cutoff (GHz)	26.0
Insertion Loss (dB)	See Chart
CW Power (Watts) @ 5 GHz	400
RF Leakage (dB) @ 5 GHz	- 90
Capacitance (pF/ft)	29
Velocity of Propogation (%)	70
Time Delay (nS/ft)	1.45
Temperature Range (°C)	-55 to +200



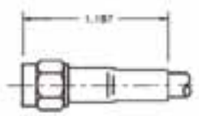
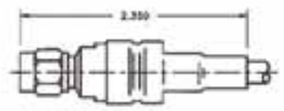
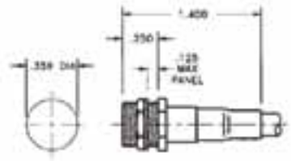
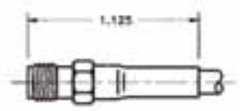
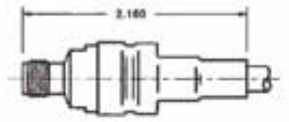
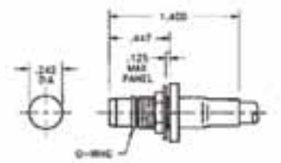
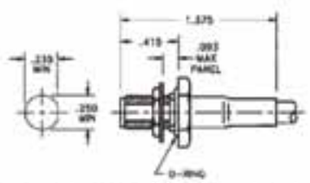
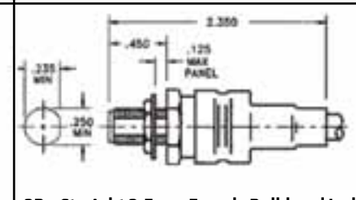
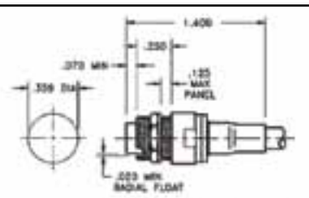
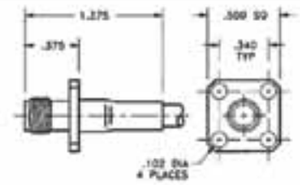
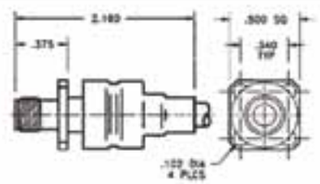
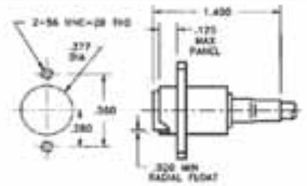
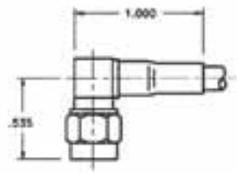
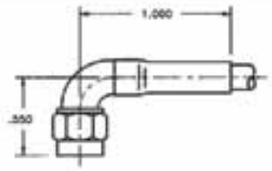
Note: Select desired Midwest Cable No. designation and substitute in Cable Assembly Model No. designation as shown on page 11.

Midwest Cable No.	42
Jacket Material	FEP
Outside Diameter - inches (mm)	0.180 (4.6)
Dia over Mechanical Shield - inches (mm)	0.156 (4.0)
Dia over Stabalizing Shield - inches (mm)	0.140 (3.6)
Dia over Electrical Shield - inches (mm)	0.130 (3.3)
Dielectric Dia - inches (mm)	0.118 (3.0)
Center Conductor Dia - inches (mm)	0.36 (9.1)
Min Bend Radius - inches (mm)	1.4 (35.6)
Weight (oz per ft)	0.75

Materials and Finishes

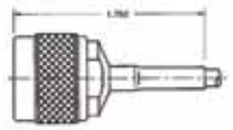
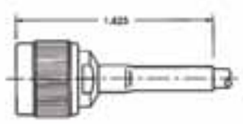
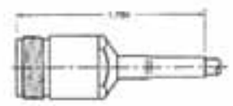
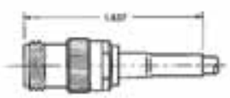
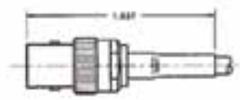
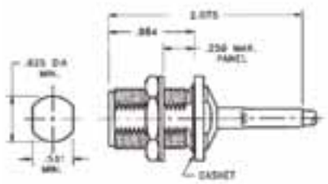
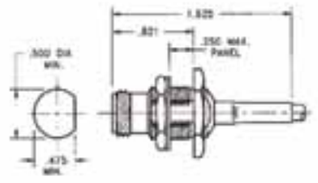
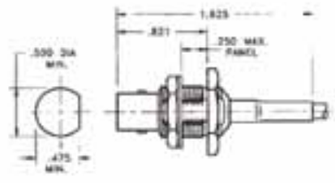
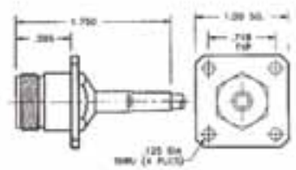
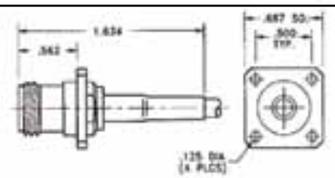
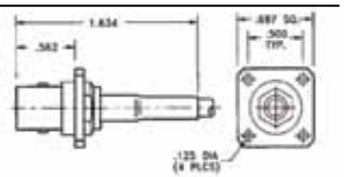
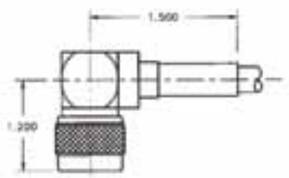
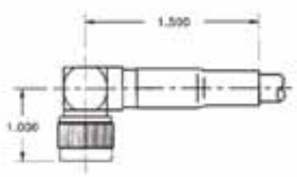
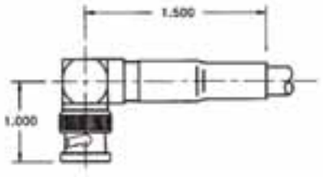
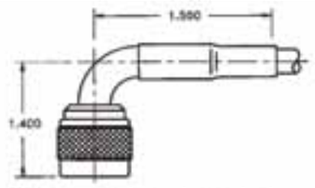
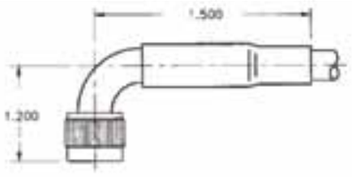
Center Conductors - Silver-coated copper clad steel per ASTM-B-298 40 micro-inches min thick per MIL-C-17.
Electrical Shields - Silver-coated flat copper per IPC-FC-221 40 micro-inches thick min per MIL-C-17.
Mechanical Shields - Silver-coated copper per ASTM-B-298 40 micro-inches thick min per MIL-C-17.
Dielectric Core - Extruded poytetrafluoroethylene (PTFE), per MIL-C-17.
Jacket - Extruded fluorinated ethylene propoylene (FEP), per MIL-C-17, Type IX.
Armor - Stainless Steel per ASTM-A-582 and ASTM-A-484.

Connector Selection Flexible Cable Assemblies

SMA	3.5mm	BMA
 SM = Straight SMA Male Plug	 3M = Straight 3.5mm Male Plug	 MF = Straight BMA Female Jack
 SF = Straight SMA Female Jack	 3F = Straight 3.5mm Female Jack	 MM = Straight BMA Male Plug
 SB = Straight SMA Bulkhead Female Jack	 3B = Straight 3.5mm Female Bulkhead Jack	 MB = Straight BMA Bulkhead Female Jack
 SP = Straight SMA Female Panel Jack	 3P = Straight 3.5mm Female Panel Jack	 MP = Straight BMA Female Panel Jack
 SA = Right Angle SMA Male Plug	N/A	N/A
 SS = Swept Right Angle SMA Male Plug	N/A	N/A

Note: Select desired Connectors and use the two letter designators in Model No. for J1 and J2 as shown on page 11.

Connector Selection Flexible Cable Assemblies

Type N	TNC	BNC
 NM = Straight N Male Plug	 TM = Straight TNC Male Plug	 BM = Straight BNC Male Plug
 NF = Straight N Female Jack	 TF = Straight TNC Female Jack	 BF = Straight BNC Female Jack
 NB = Straight N Bulkhead Female Jack	 TB = Straight TNC Female Bulkhead Jack	 BB = Straight BNC Bulkhead Female Jack
 NP = Straight N Female Panel Jack	 TP = Straight TNC Female Panel Jack	 BP = Straight BNC Female Panel Jack
 NA = Right Angle N Male Plug	 TA = Right Angle TNC Male Plug	 BA = Right Angle BNC Male Plug
 NS = Swept Right Angle N Male Plug	 TS = Swept Right Angle TNC Male Plug	N/A

Note: 7mm, SC, and HN series and other connectors are also available, consult factory for designations and dimensions.

Comformable Cable Specifications

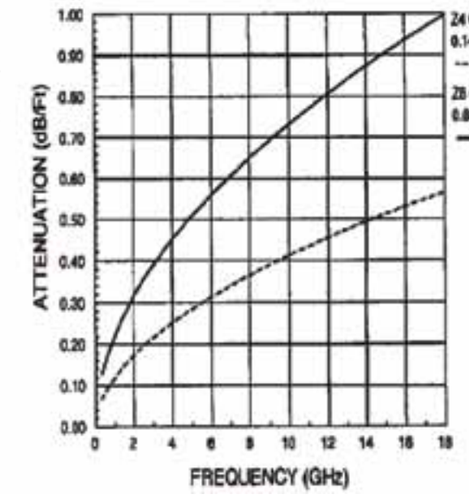
Improved Hand Formable/Reformable

- **100% Effective Shielding**
- **Avoid Expensive Bending Tolerances**
- **Low VSWR and Loss Performance**
- **Excellent Cost / Performance Ratio**
- **SMA, BMA, 3.5mm,7mm, N, TNC, BNC**

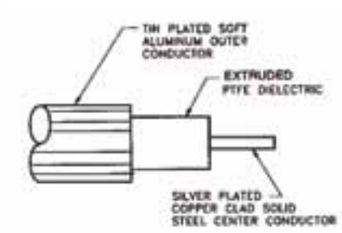
The Midwest Microwave product line from Emerson Connectivity Solutions, offers improved versions of Conformable Cable Assemblies that are low in cost and use standard connectors. By improving the flexibility of the outer conductor construction of these conformable cables a very high level of conformability has been achieved. Because it uses standard off the shelf connectors, a very good cost / performance ratio cable assembly can be accomplished. Useable on many applications where standard bent semi-rigid cables (RG402/U and RG405/U) were not acceptable, these new conformable versions allow the performance criteria to be met for a much more reasonable price than other higher cost options.

CONFORMABLE CABLE SPECIFICATIONS

Midwest Cable No.	Z4	Z8
Outside Diameter - inches (mm)	0.141 (3.6)	0.085 (2.2)
Impedance (Ohms)	50 ± 1 Ohms	50 ± 1.5 Ohm
Center Conductor Type	Solid	Solid
Frequency Cutoff (GHz)	36.0	40.0
Insertion Loss (dB)	See Chart	See Chart
CW Power (Watts) @ 5 GHz	120	35
RF Leakage (dB) @ 5 GHz	- 90	- 90
Capacitance (pF/ft)	29	29
Velocity of Propogation (%)	69.5	69.5
Time Delay (nS/ft)	1.43	1.43
Temperature Range (C°)	-40 to +125	-40 to +125



Note: Select desired Cable designation and substitute in Cable Assembly Model No. designation as shown on page 11.



Midwest Cable No.	Z4	Z8
Jacket Material	Al / Sn	Al / Sn
Outside Diameter - inches (mm)	0.141 (3.6)	0.085 (2.2)
Dielectric Dia - inches (mm)	0.1175 (3.0)	0.066 (1.7)
Center Conductor Dia - inches (mm)	0.0362 (0.92)	0.0201 (0.51)
Min Bend Radius - inches (mm)	0.125 (3.2)	0.07 (1.8)
Weight (oz per ft)	0.32	0.128

Materials and Finishes

Center Conductor - Silver-coated copper clad steel per ASTM-B-298 40 micro-inches min thick per MIL-C-17.
Dielectric Core - Extruded Polytetrafluoroethylene (PTFE), per MIL-C-17.
Outer Jacket - Aluminum-Tin Composite

Conformable Cable Specifications

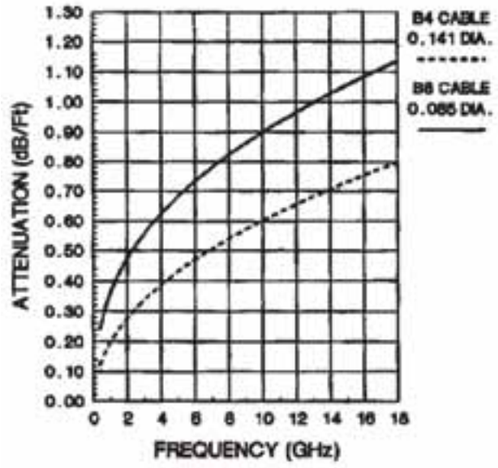
Improved Conformable Cable

- **Hand Formable-Reformable**
- **Low Cost-High Performance**
- **Avoid Expensive Bending Tolerances**
- **Excellent Cost / Performance Ratio**
- **SMA, BMA, 3.5mm, 7mm, N, TNC, BNC**

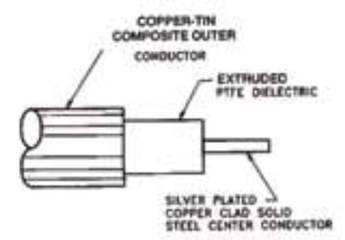
The Midwest Microwave product line from Emerson Connectivity Solutions, offers improved versions of Conformable Cable Assemblies that are low in cost and use standard connectors. The copper-tin composite outer conductor of these conformable cables provides the same 100% shielding as solid-jacketed semi-rigid, but is easily formed by hand. Combined with the use of standard connectors, a very high cost / performance ratio cable assembly has been achieved. Useable on many applications where standard bent semi-rigid cables were not acceptable, these new conformable versions allow the performance criteria to be met for a much more reasonable price than other higher cost options.

CONFORMABLE CABLE SPECIFICATIONS

Midwest Cable No.	B4	B8
Outside Diameter - inches (mm)	0.141 (3.6)	0.085 (2.2)
Impedance (Ohms)	50 ± 2 Ohms	50 ± 2 Ohms
Center Conductor Type	Solid	Solid
Frequency Cutoff (GHz)	36.0	40.0
Attenuation (dB/ft)	See Chart	See Chart
CW Power (Watts) @ 5 GHz	120	35
RF Leakage (dB) @ 5 GHz	- 90	- 90
Capacitance (pF/ft)	29	29
Velocity of Propogation (%)	69.5	69.5
Time Delay (nS/ft)	1.43	1.43
Temperature Range (°C)	-40 to +200	-40 to +200



Note: Select desired Midwest Cable No. and substitute in Cable Assembly Model No. designation as shown on page 11.



Midwest Cable No.	B4	B8
Jacket Material	Cu / Sn	Cu / Sn
Outside Diameter - inches (mm)	0.141 (3.6)	0.085 (2.2)
Dielectric Dia - inches (mm)	0.1175 (3.0)	0.066 (1.7)
Center Conductor Dia - inches (mm)	0.0362 (0.92)	0.0201 (0.51)
Min Bend Radius - inches (mm)	0.100 (2.5)	0.50 (1.3)
Weight (oz per ft)	0.5	0.16

Materials and Finishes

Center Conductor - Silver-coated copper clad steel per ASTM-B-298 40 micro-inches min thick per MIL-C-17.
Dielectric Core - Extruded Polytetrafluoroethylene (PTFE), per MIL-C-17.
Outer Jacket - Copper-Tin Composite.

Flexiform Hand Formable Cable Specifications

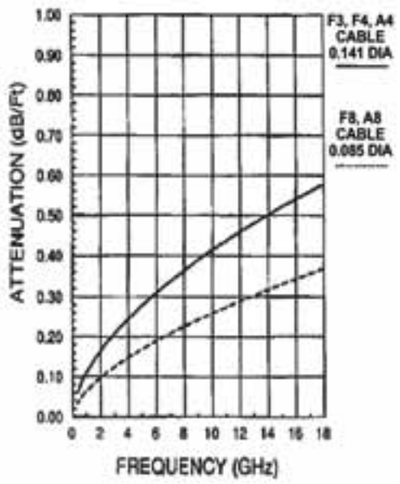
Hand Formable / Reformable Cable

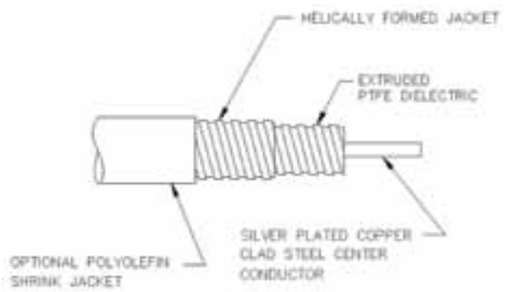
- **Helically Formed Copper, Stainless Steel or Aluminum Jacket**
- **Replaces Semi-Rigid Cable**
- **Phase and Temperature Stable**
- **Fits Standard Connectors**

The Midwest Microwave product line from Emerson Connectivity Solutions, offers these hand formable and reformable semi-flexible cables in diameters of .141 and .086. It can be hand formed to almost any shape required and be re-formed, if necessary, eliminating the need for complex drawings and costly dimensional inspections. The special construction of Flexiform cable provides superior phase amplitude stability, high impact strength, and excellent stability over temperature.

F3, F4, F8, A4, A8 CABLE SPECIFICATIONS

Midwest Cable No.	F3	F4	F8	A4	A8
Outside Diameter - Inches(mm)	.141 (3.6)	.141 (3.6)	.085 (2.2)	.141 (3.6)	.085 (2.2)
Jacket Material	Tin Plated Copper Coated Stainless Steel	Copper	Copper	Tin Plated Aluminum	Tin Plated Aluminum
Dielectric Diameter	.1175 (2.3)	.1175 (2.3)	.066 (1.7)	.1175 (2.3)	.066 (1.7)
Dielectric Material	Solid PTFE	Solid PTFE	Solid PTFE	Solid PTFE	Solid PTFE
Center Conductor Diameter	0.0362 (0.92)	0.0362 (0.92)	0.0201 (0.51)	0.0362 (0.92)	0.0201 (0.51)
Center Conductor Material	Silver Coated Copper Clad Steel	Silver Coated Copper Clad Steel	Silver Coated Copper Clad Steel	Silver Coated Copper Clad Steel	Silver Coated Copper Clad Steel
Impedance (Ohms)	50 +/-2	50 +/-2	50 +/-2	50 +/-2	50 +/-2
Frequency Cut off (GHz)	36	36	40	36	40
Attenuation (dB/ft)	See Chart	See Chart	See Chart	See Chart	See Chart
CW Power (Watts) @5 GHz	90	120	35	95	27
RF Leakage (dB) @5GHz	-90	-90	-90	-90	-90
Capacitance (pF/ft)	29	29	29	29	29
Velocity of Propogation (%)	69.5	69.5	69.5	69.5	69.5
Time Delay (nS/ft)	1.46	1.46	1.46	1.46	1.46
Temperature Range (°C)	-40 to +125	-40 to +125	-40 to +125	-40 to +125	-40 to +125





Materials and Finishes

Center Conductor - Silver-coated copper clad steel per ASTM-B-298 40 micro-inches min thick per MIL-C-17.
Dielectric Core - Extruded Polytetrafluoroethylene (PTFE), per MIL-C-17.
Outer Jacket - F4 & F8 - Helically Formed Copper. F3 - Helically Formed Tin Plate with Copper Coated Stainless Steel. A4 & A8 - Helically Formed Tin Plated Aluminum.

.250, .141 and .085 Semi-Rigid Cable Specifications

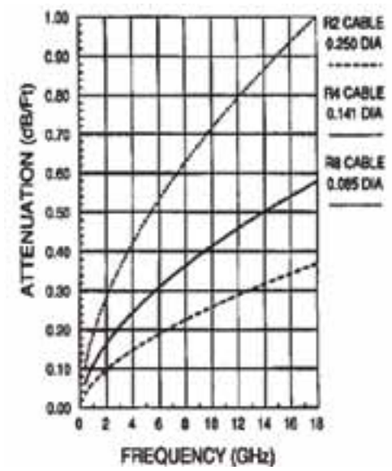
Custom Precision Bent Cable Assemblies

- .085, .141, and .250 Dia Semi-Rigid Cable
- Custom Bent Cofigurations
- Electrically Tested
- SMA, BMA, 3.5mm, N, TNC, and SC Connectors

The Midwest Microwave product line from Emerson Connectivity Solutions, offers a complete assortment of custom bent precision formed semi-rigid cable assemblies to fit your system requirements. They are available in a wide choice of compatible connector interface types and are custom formed to user specifications. They can be supplied in a number of finishes with custom identification markers. Phase matched and time delay assemblies can also be supplied to specific specifications upon request.

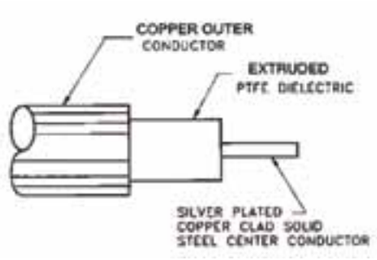
SEMI-RIGID CABLE SPECIFICATIONS

Midwest Cable No.	R2	R4	R8
Outside Diameter - inches (mm)	0.250 (6.4)	0.141 (3.6)	0.085 (2.2)
Impedance (Ohms)	50 ± 1 Ohms	50 ± 1 Ohms	50 ± 1 Ohms
Center Conductor Type	Solid	Solid	Solid
Frequency Cutoff (GHz)	19.0	36.0	40.0
Attenuation (dB/ft)	See Chart	See Chart	See Chart
CW Power (Watts) @ 5 GHz	300	120	35
RF Leakage (dB) @ 5 GHz	- 90	- 90	- 90
Capacitance (pF/ft)	29	29	29
Velocity of Propogation (%)	69.5	69.5	69.5
Time Delay (nS/ft)	1.43	1.43	1.43
Temperature Range (°C)	-40 to +125	-40 to +125	-40 to +125



Notes: 1. Tin or Silver plating of outer jacket can be designated by substituting "T2", "T4", or "T8" for tin plating or "S2", "S4", or "S8" for silver plating when defining the Cable Assembly Model No. (see page 11).

2. A Polyolefin shrink jacket to protect the outer conductor can be designated by indicating a "J" for Ruggedization selection in the Model No. (see page 11).

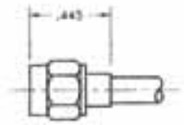
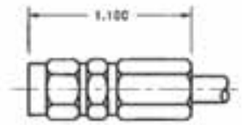
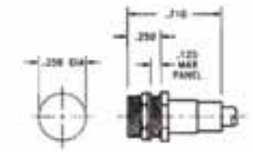
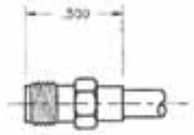
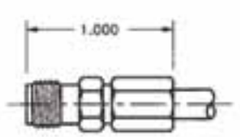
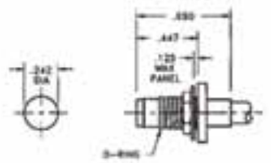
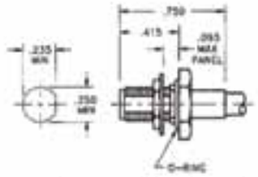
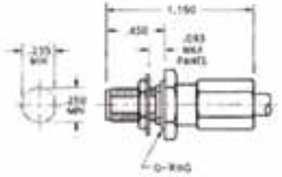
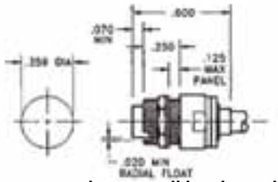
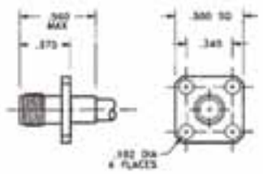
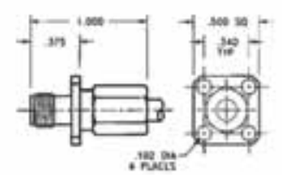
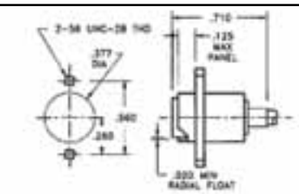
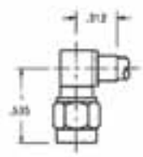
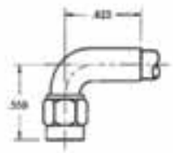


Midwest Cable No.	R2	R4	R8
Jacket Material	Copper	Copper	Copper
Outside Diameter - inches (mm)	0.250 (6.4)	0.141 (3.6)	0.085 (2.2)
Dielectric Dia - inches (mm)	0.209 (5.3)	0.1175 (2.3)	0.066 (1.7)
Center Conductor Dia - inches (mm)	0.0641 (1.6)	0.0362 (0.92)	0.0201 (0.51)
Min Bend Radius - inches (mm)	0.375 (9.5)	0.250 (6.4)	0.225 (3.2)
Weight (oz per ft)	1.6	0.61	0.24

Materials and Finishes

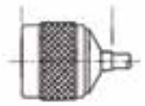
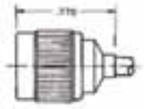
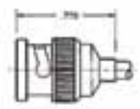
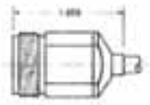
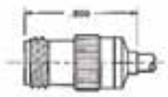
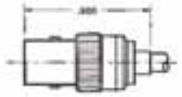
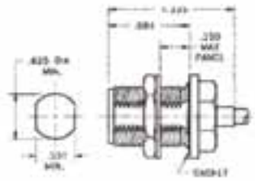
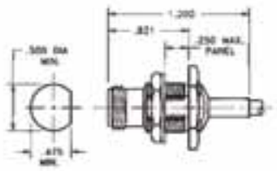
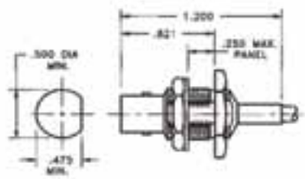
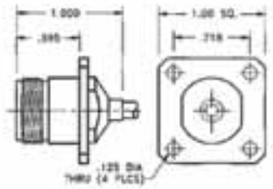
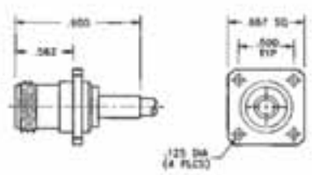
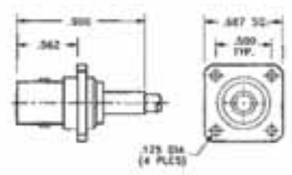
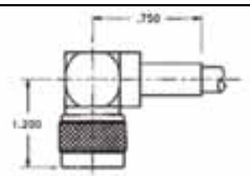
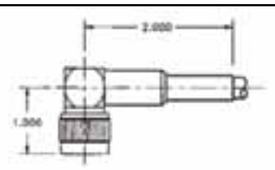
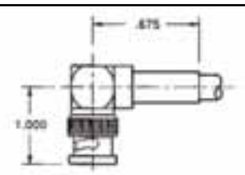
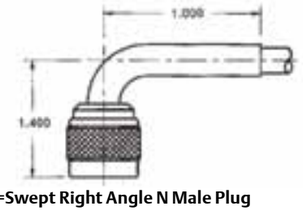
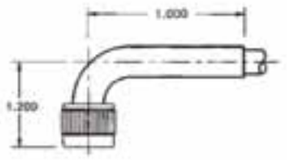
Center Conductor - Silver-coated copper clad steel per ASTM-B-298 40 micro-inches min thick per MIL-C-17.
Dielectric Core - Extruded Polytetrafluoroethylene (PTFE), per MIL-C-17.
Outer Jacket - Copper.

Connector Selection Semi-Rigid and Formable Cable

SMA	3.5mm	BMA
 SM = Straight SMA Male Plug	 3M = Straight 3.5mm Male Plug	 MF = Straight BMA Female Jack
 SF = Straight SMA Female Jack	 3F = Straight 3.5mm Female Jack	 MM = Straight BMA Male Plug
 SB = Straight SMA Bulkhead Female Jack	 3B = Straight 3.5mm Female Bulkhead Jack	 MB = Straight BMA Bulkhead Female Jack
 SP = Straight SMA Female Panel Jack	 3P = Straight 3.5mm Female Panel Jack	 MP = Straight BMA Female Panel Jack
 SA = Right Angle SMA Male Plug	N/A	N/A
 SS = Swept Right Angle SMA Male Plug	N/A	N/A

Note: Select Connector designation letters and substitute in Cable Assembly Model No. designation as shown on page 11.

Connector Selection Semi-Rigid and Formable Cable

Type N	TNC	BNC
 NM=Straight N Male Plug	 TM=Straight TNC Male Plug	 BM= Straight BNC Male Plug
 NF=Straight N Female Jack	 TF=Straight TNC Female Jack	 BF=Straight BNC Female Jack
 NB=Straight N Bulkhead Female Jack	 TB=Straight TNC Female Bulkhead Jack	 BB=Straight BNC Bulkhead Female Jack
 NP=Straight N Female Panel Jack	 TP=Straight TNC Female Panel Jack	 BP=Straight BNC Female Panel Jack
 NA=Right Angle N Male Plug	 TA=Right Angle TNC Male Plug	 BA=Right Angle BNC Male Plug
 NS=Swept Right Angle N Male Plug	 TS=Swept Right Angle TNC Male Plug	N/A

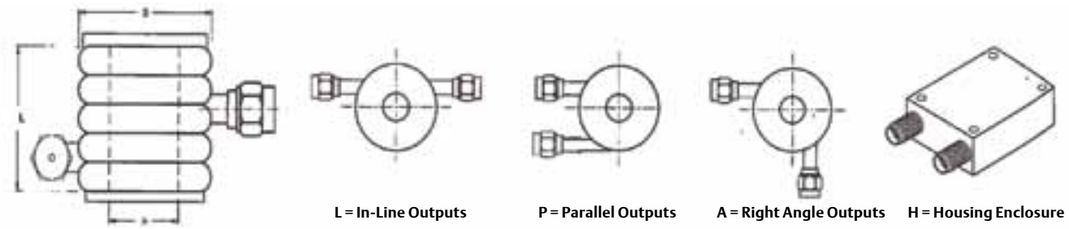
Note: 7mm, SC, and HN series and other connectors are also available, consult factory for designations and dimensions.

Coaxial Delay Lines

Custom Delay Line Assemblies

- **5, 10, 25, 50, and 100 nanosecond Delay**
- **Calibration Standards**
- **Spooled, Encapsulated or Packaged**
- **N, TNC, and SMA Connectors**

The Midwest Microwave product line from Emerson Connectivity Solutions offers standard as well as custom coaxial delay lines that are a very reliable way of providing short interval delays for a wide variety of applications. These coaxial delay line assemblies are ideal for use in the laboratory or the microwave system. They can be supplied in open coil form or epoxy encapsulated and housed in an enclosure that can be rack mounted in a system or test instrumentation.



L = In-Line Outputs | P = Parallel Outputs | A = Right Angle Outputs | H = Housing Enclosure

MODEL NUMBER DESIGNATION

DLY- □□□□–□□–□□□–□□

- Connector J1
- Connector J2
- Cable Type
- Delay (nS)
- Delay Line Product Prefix

Delay Formulas

Delay = T = 1.016 $\sqrt{\varepsilon}$ = nS/ft.

Length = cable = $\frac{0.984\,T}{\sqrt{\varepsilon}}$

Y = Enclosure Option

S = Standard Spool
H = Housing Enclosure
E = Epoxy Encapsulated
C = Custom Enclosure

X= Output Configuration

L = In-Line outputs
P = Paralell Outputs
A = Right Angle Outputs
E= Outputs at one end
B= Outputs at both ends

Delay Line Type	Delay (ns)	Model No.	Dimensions in (mm)			Weight oz (gr)	Cable Length ft (m)
			L	D	H		
Subminiature 0.085 Diameter Cable	5	DLY-J1J2-R8-005-XY	1.25 (31.8)	1.75 (44.5)	1.00 (25.4)	2.5 (70.9)	3.5 (1.06)
	10	DLY-J1J2-R8-010-XY	1.25 (31.8)	1.75 (44.5)	1.00 (25.4)	3.5 (99.2)	7.0 (2.13)
	25	DLY-J1J2-R8-025-XY	2.25 (57.2)	1.75 (44.5)	1.00 (25.4)	7.0 (198.5)	17.5 (5.334)
	50	DLY-J1J2-R8-050-XY	2.25 (57.2)	2.25 (57.2)	1.00 (25.4)	14.0 (396.9)	35.0 (10.67)
Miniature 0.141 Diameter Cable	5	DLY-J1J2-R4-005-XY	1.75 (44.5)	2.25 (57.2)	1.50 (38.1)	4.0 (113.4)	3.5 (1.06)
	10	DLY-J1J2-R4-010-XY	3.00 (76.2)	2.25 (57.2)	1.50 (38.1)	8.0 (226.8)	7.0 (2.13)
	25	DLY-J1J2-R4-025-XY	4.75 (120.7)	2.50 (63.5)	1.50 (38.1)	14.0 (396.9)	17.5 (5.334)
	50	DLY-J1J2-R4-050-XY	5.00 (127.0)	3.00 (76.2)	1.50 (38.1)	20.0 (567.0)	35.0 (10.67)
	100	DLY-J1J2-R4-100-XY	6.25 (158.8)	3.00 (76.2)	1.50 (38.1)	35.0 (992.3)	70.0 (21.34)
Miniature 0.141 Diameter Cable	5	DLY-J1J2-R2-005-XY	2.00 (50.8)	5.50 (139.7)	4.00 (101.6)	8.0 (226.8)	3.5 (1.06)
	10	DLY-J1J2-R2-010-XY	3.00 (76.2)	5.50 (139.7)	4.00 (101.6)	14.0 (396.8)	7.0 (2.13)
	25	DLY-J1J2-R2-025-XY	3.50 (98.9)	5.50 (139.7)	4.00 (101.6)	32.0 (907.2)	17.5 (5.334)
	50	DLY-J1J2-R2-050-XY	5.00 (127.2)	5.50 (139.7)	4.00 (101.6)	60.0 (1701.0)	35.0 (10.67)
	100	DLY-J1J2-R2-100-XY	9.00 (228.6)	5.50 (139.7)	4.00 (101.6)	125 (3543.8)	70.0 (21.34)

Notes

Get Connected...

Emerson Network Power Connectivity Solutions has a wide range of cable assemblies and connectors suited for RF, Microwave and Fiber Optic signal transmission. Connectivity Solutions is a vertically integrated supplier of custom, fixed length and semi rigid cable assemblies from DC to 50 GHz. Our product lines deliver custom-engineered products and solutions to satisfy the most demanding and complex requirements.

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Emerson Network Power Connectivity Solutions, an Emerson business, serves the needs of wireless communications, military, telephony and data networks, CATV security systems, health care and industrial facilities with a full spectrum of RF/microwave and fiber optic connectivity products. For more information, visit **www.EmersonConnectivity.com**

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