

*Beamformers are networks that perform vector manipulation of two or more inputs to produce two or more outputs which when fed to or from an antenna array represent coordinates in a three dimensional system.*

*TRM utilizes stripline, microstrip, coaxial, or ferrite technology to optimize the electrical, mechanical, and environmental requirements of any application. Our standard hybrids can have either equal or unequal power splits depending on the requirement need. By controlling this coaxial line to very tight tolerances TRM's beamformers offer excellent phase and amplitude balance. Our design capability includes integrating active circuits as necessary to provide switched and digitally controlled devices.*

*Since beamforming networks are almost exclusively custom designs the components shown here are a top-level view of examples of our innovative engineering approach.*



## Examples

### 4 x 4 Broadband Beamformer

Serving both airborne and communication system applications this broadband multi-octave component combines ferrite, coaxial and microstrip technologies achieving high performance in a low profile, small footprint (2.0 x 3.5 x 0.7 inches). This unit is also used in military radar warning receiver (RWR) designs and early warning and countermeasure control systems. Internally, it incorporates eight- zero degree dividers, four- zero degree combiners, four- 180° combiners and 50 ohm coax delay lines.

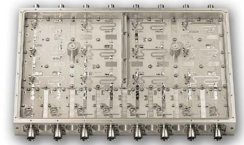


#### Typical Specifications

Frequency Range	Insertion Loss	Isolation	VSWR	Phase Balance
500-2000 MHz	2.5dB	18 dB	1.5:1	+/- 5°

### 8 x 8 Butler Matrix

A Unique combination of an eight-by-eight Butler Matrix with integrated phasing networks, this beamformer design is capable of handling a broad range of antenna patterns. The multi-layer architecture coupled with both microstrip and coaxial technologies provides extremely low loss and high power handling capability.

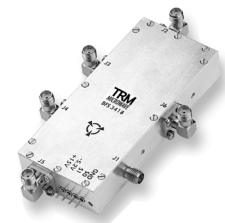


#### Typical Specifications

Frequency Range	Insertion Loss	Isolation	VSWR	Phase Balance
1025-1095 MHz	1 dB	18 dB	1.30:1	+/- 3°

### Broadband 1 x 4 Switched Beamformer

This design employs ferrite, coaxial, and microstrip technology in order to cover a multi-octave bandwidth. The design incorporates four 90° hybrids, two phase shifters a SPT4T switch with driver. The housing is nickel plated aluminum and measures 2.5 x 6.0 x 0.6 inches, plus SMA connectors. Designed for harsh airborne environmental conditions.



#### Typical Specifications

Frequency Range	Insertion Loss	Isolation	VSWR	Phase Balance
1-2 GHz	1.5 dB	25 dB	1.5:1	+/- 5°



## Airborne AFT Compensation Module

The CIM AFT is a microwave distribution network for the aft looking antenna of a leading edge fighter aircraft. The three layer, stripline circuitry consists of 17 couplers and one 4-way power divider integrated into a small overall package size of 6.0 x 1.75 x 0.7 inches. Interconnection is achieved via 17 GPO male blind mate connectors on one surface and 20 OSSP male connectors on the opposite surface. All RF connections and housing are hermetically sealed.

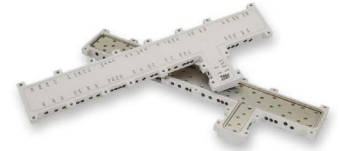


### Typical specifications

Frequency Range	Insertion Loss	Isolation	VSWR	Phase Balance
Ku Band	1 dB	38 dB	1.5:1	+/- 2°

## Airborne Distribution Network

The CIM Forward module is a microwave distribution network for the forward looking antenna of a sophisticated, contemporary fighter aircraft. The circuitry consists of fifty six couplers, two 4-way power dividers, and two 3dB hybrids all integrated into a small package size of 12 x 1.6 x 0.5 inches. Comprised of 123 RF ports which employ male GPO blind mate coaxial connectors, this unit performs over a 3:1, and in some cases, a 9:1 bandwidth.



### Typical specifications

Frequency Range	Insertion Loss	Isolation	VSWR	Phase Balance
Ku Band	1 dB	38 dB	1.5:1	+/- 2°

## 4 x 3 Butler Matrix

This flatpack drop-in beamformer uses radial leads on a seam welded package to allow for surface mount orientation. It is light weight (0.8 sq. x 0.17 inches high) and is designed to perform in the harshest environments. Internally this ferrite unit has three 180° hybrids and a 0° power divider. This approach has been employed in many missile and aircraft applications.



### Typical specifications

Frequency Range	Insertion Loss	Isolation	VSWR	Phase Balance
145 - 175 MHz	3.5 dB	20 dB	1.45:1	+/- 2.5°

