



**MOTOROLA**

# UHF EXTERNAL DOUBLE CIRCULATOR MODULE

Model CLN1210 (403 to 470 MHz)

## 1

## DESCRIPTION

The UHF External Double Circulator Module, Model CLN1210 X676AW, provides 45 dB (minimum) of isolation between the Power Amplifier Module and the transmit antenna.

This section provides a general description, option matrix chart, identification of inputs/outputs, and functional theory of operation. The information provided is sufficient to give service personnel a functional understanding of the module, allow maintenance and troubleshooting to the module level. (Refer also to the Maintenance and Troubleshooting section of this manual for detailed troubleshooting procedures for all modules in the station.)

### General Description

The double circulator assembly consists of two RF circulators (contained in a single housing, a 50 $\Omega$  load with heat sink and Low Pass Filter, all mounted in the peripheral tray. The RF output from the Power Amplifier module connects to the input of the assembly, while the output connects to an external low pass filter. The low pass filter provides harmonic suppression for the MTR2000 station. The output of the filter connects to the transmit antenna (directly, via antenna relay module, or via duplexer).



The double circulator option is typically used in high density radio site applications where other co-located transmitters near the frequency of the station can cause intermodulation products. The addition of the double circulator improves transmitter intermodulation by 45 dB.

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INPUTS AND OUTPUT CONNECTIONS

Figure 1 shows the UHF External Double Circulator input and output connections.

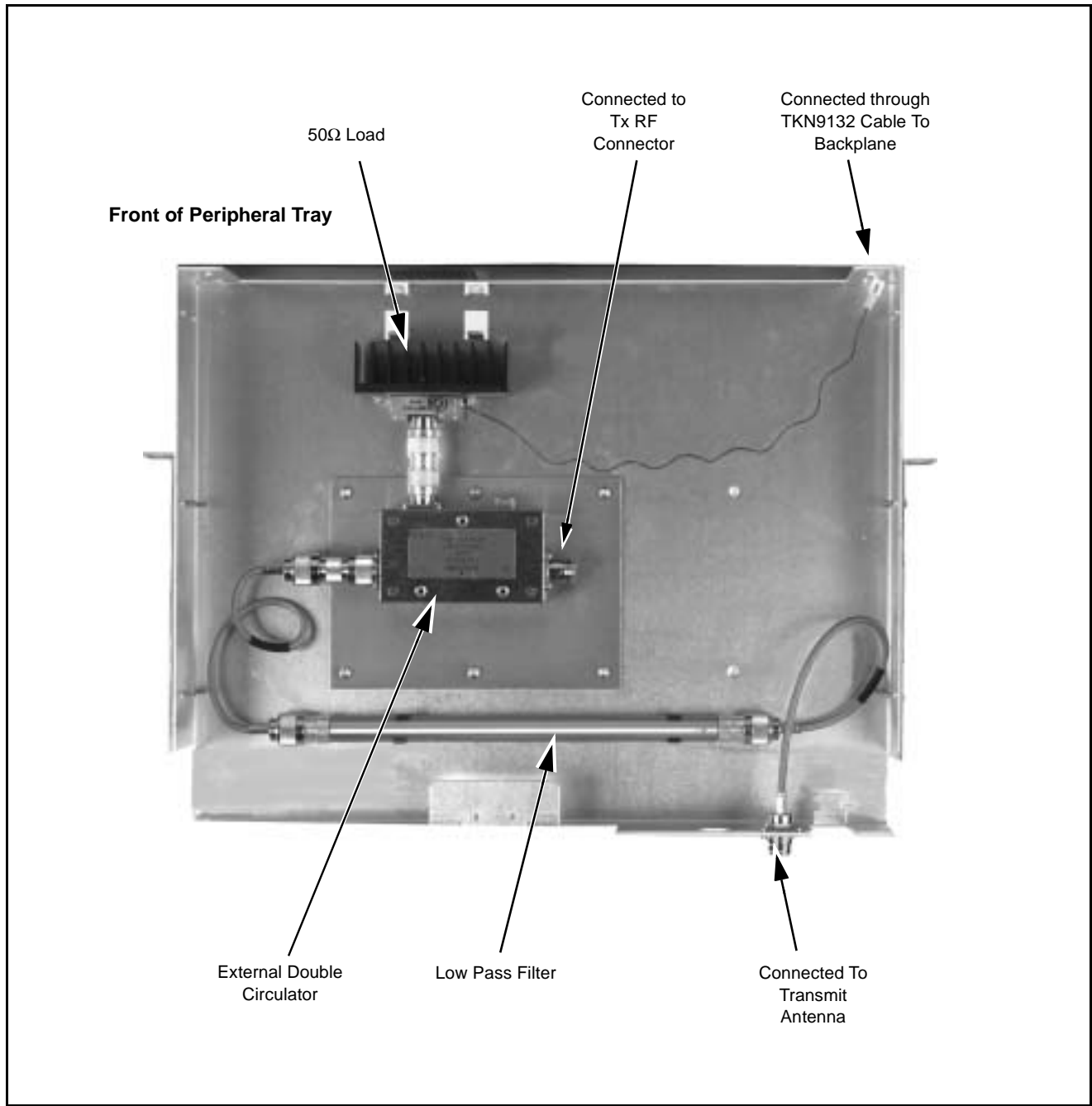


Figure 1. UHF External Double Circulator Mounted in Peripheral Tray – Inputs/Outputs

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## Cables

The set of cables used to connect an External Double Circulator to the MTR2000 station depends on what ancillary equipment is connected to the station.

A station can be configured with the following ancillary equipment:

- an External Double Circulator only.  
Figure 2 shows the kits required to install this equipment on a station.
- an External Double Circulator and an External Preselector.  
Figure 3 shows the kits required to install this equipment on a station.
- an External Double Circulator and an Antenna Relay.  
See the Antenna Relay, Cables section for details.
- an External Double Circulator, an Antenna Relay, and an External Preselector.  
See the Antenna Relay, Cables section for details.
- an External Double Circulator and a Duplexer.  
See the Duplexer, Cables section for details.

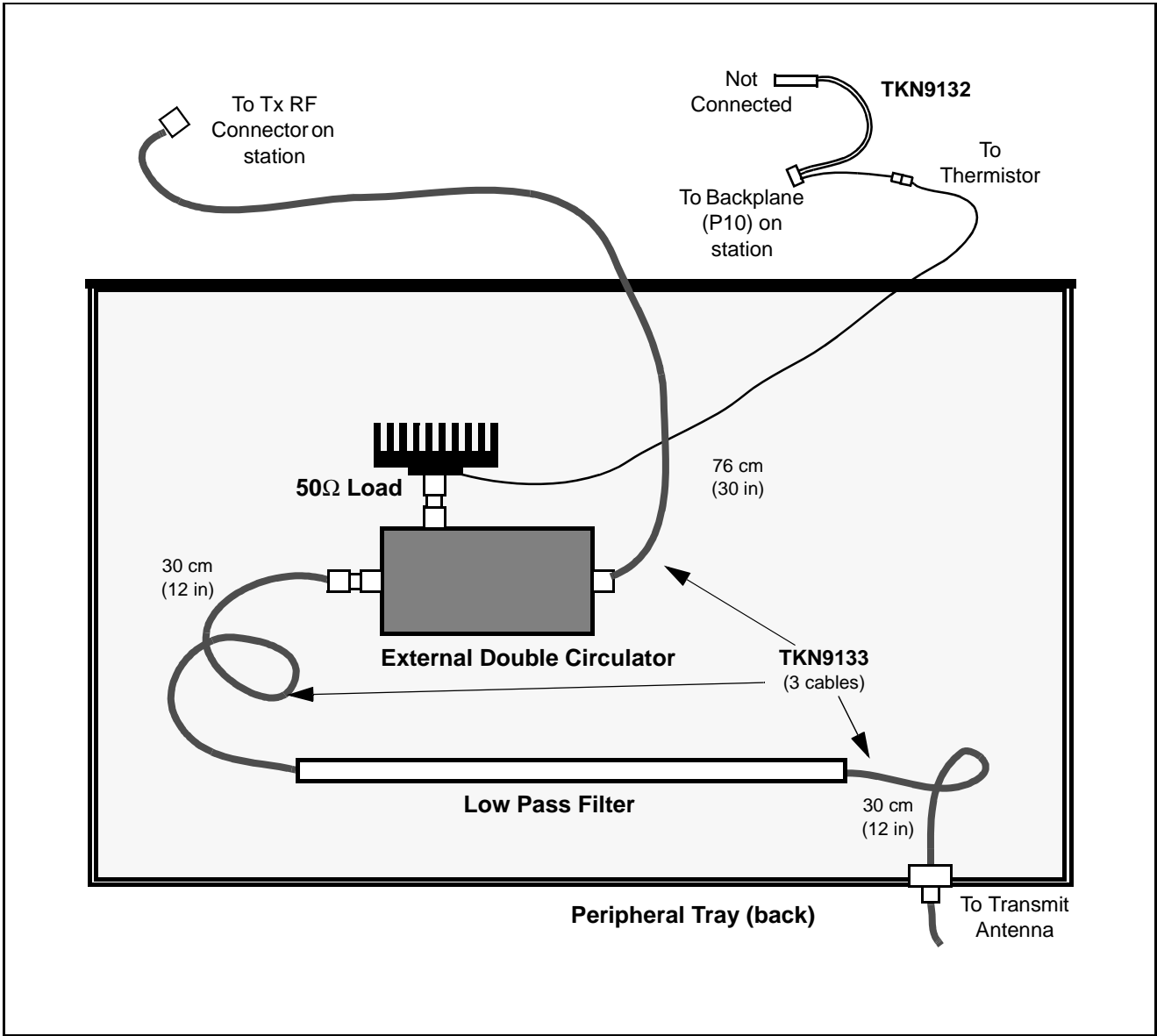


Figure 2. External Double Circulator Only – Cable Kits

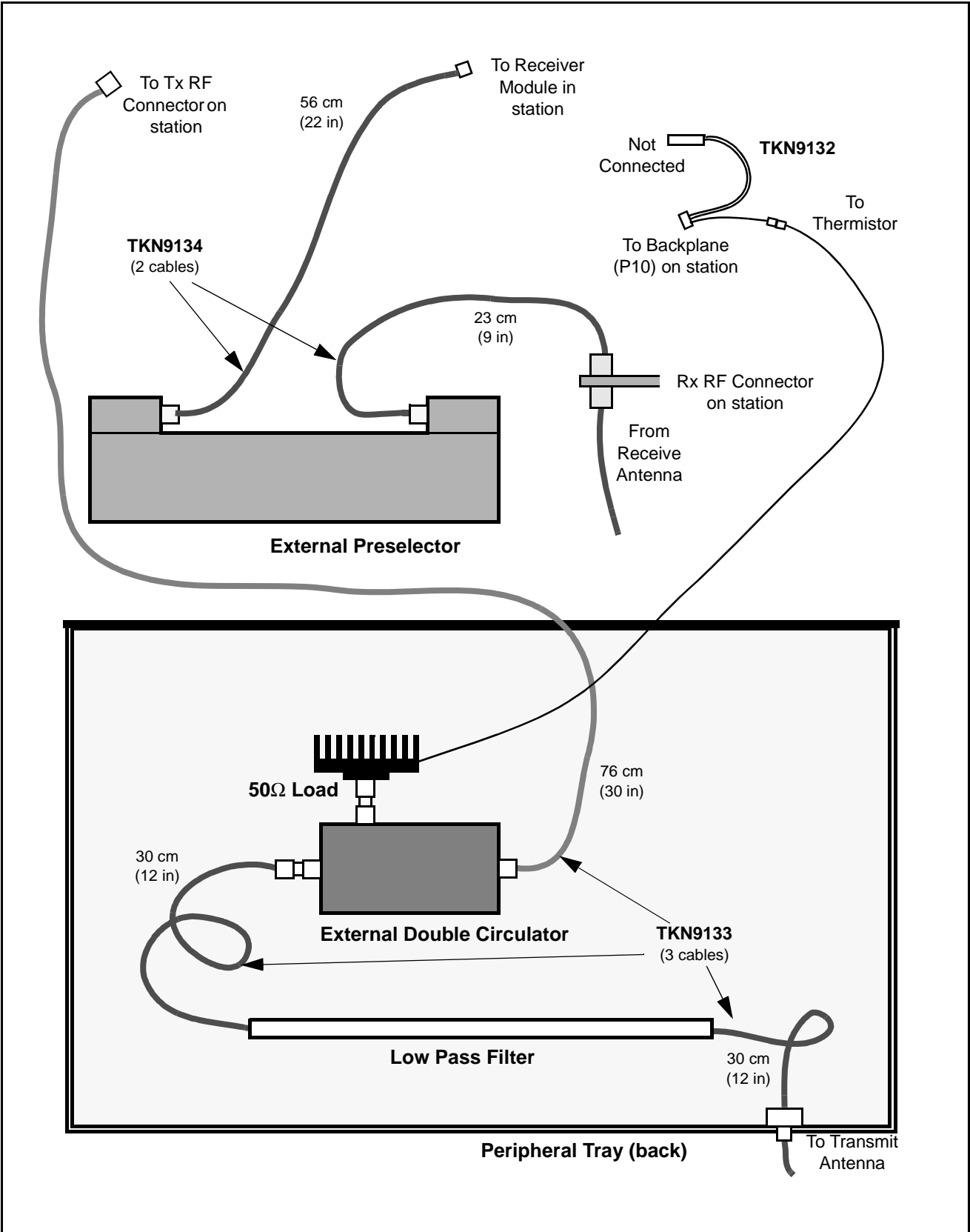


Figure 3. External Double Circulator and External Preselector- Cable Kits

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OPTIONS COMPLEMENT

Table 1 shows the contents of the Double Circulator option.

Option Complement Chart

Table 1. UHF External Double Circulator Option X676AW Complement

Application	Option Contents	
MTR2000 Station 403 to 470 MHz	TLF7320A	Double Circulator assembly
	TLF7340A	Low Pass Filter
	TRN7751A	Peripheral Mounting Tray
	TKN9133A	Cables (peripheral tray)
	TLN3391A	50Ω Load (head sink mounted)

**4****PERFORMANCE SPECIFICATIONS**

Table 2 shows the electrical performance specifications for the external Dual Circulator used in Model CLN1210.

**Performance Specifications**

**Table 2. Performance Specifications for CLN1210 External Double Circulator**

Parameter	Specifications
Operating Frequency	403 to 470 MHz
Maximum RF Input Power	400 W
Insertion Loss	1.2 dB maximum
Isolation	45 dB
Operating Temperature Range	-20° C to +70° C
Terminations	Female N-Type
Input / Output Return Loss	19.1 dB minimum
Input and Output Impedance	50 Ohms
Thermistor Value	20k $\Omega$ @ 25°C 2.6k $\Omega$ @ 80°C

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FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the Dual Circulator Assembly at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the double circulator in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 4 for a block and interconnect diagram of the Double Circulator assembly.

Functional Operation

The double circulator assembly accepts transmit RF output power from the Power Amplifier module and provides 45 dB of isolation between the Power Amplifier module and the transmit antenna. The assembly consists of two circulators in a single case, each with a 50Ω load. Each circulator allows forward RF energy to pass through to the output, while routing any reflected RF energy to the corresponding 50Ω load. Refer to the block diagram shown in Figure 4.

Most of the reflected energy is absorbed by the 50Ω load (heat sink) mounted) connected to the second circulator. A thermistor mounted on the head sink provides a variable resistance signal proportional to the heat sink temperature. This signal is routed to the Station Control Module via the Temp Sense cable and backplane. If the heat sink temperature exceeds a preset threshold, the Station Control Module enables PA cutback mode.

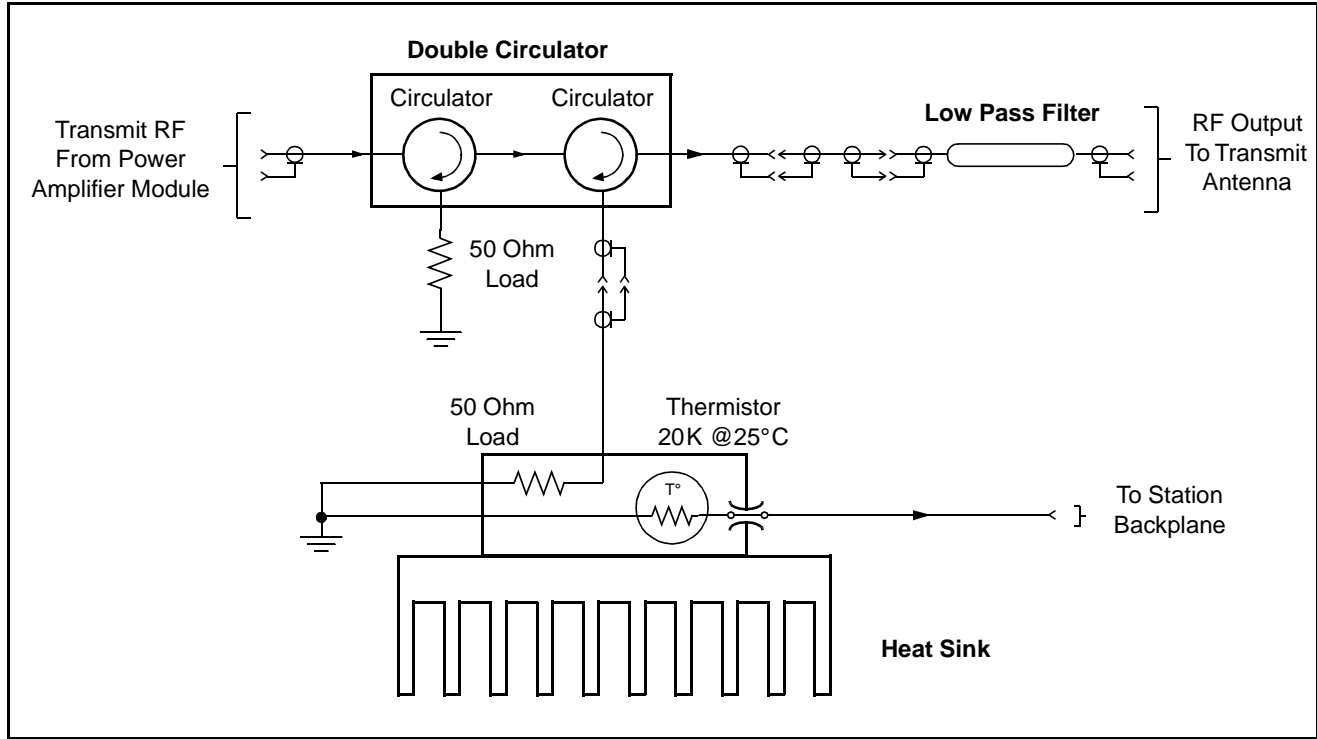


Figure 4. Functional Block and Interconnect Diagram for External Double Circulator Module