MOTOROLA

ANTENNA RELAY MODULE

Option X371AA

1 DESCRIPTION

Option X371AA provides an antenna relay module for use with *Quantar* and *Quantro* station products. This section provides a general description, option complement, identification of inputs/outputs, and functional theory of operation. The information provided is sufficient to give service personnel a functional understanding of the module, allowing 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

This antenna relay module allows a single antenna to be used for both transmit and receive functions (base station applications only). The antenna relay is controlled by a signal from the Station Control Module to connect the antenna to either the Power Amplifier Module (transmit) or Receiver Module (receive). The antenna relay module is mounted on an angle bracket provided on the rear of the station card cage.

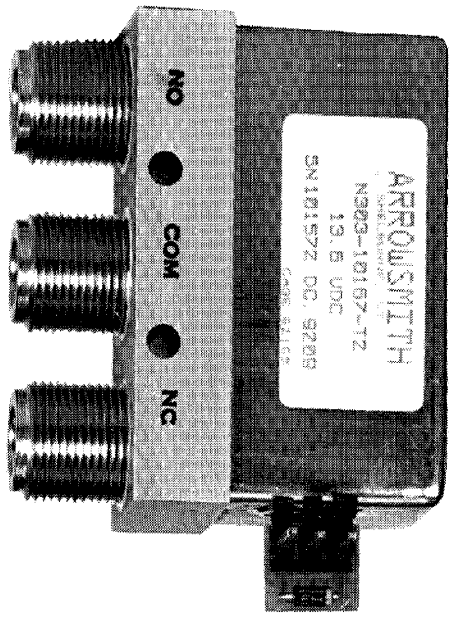

Figure 1. Typical Antenna Relay Module

Commercial Government and Industrial Solutions Sector
1301 E. Algonquin Road, Schaumburg, IL 60196

68P81086E22–B
9/1/00–UP

2 INPUT AND OUTPUT CONNECTIONS

Figure 2 shows the antenna relay module input and output external connections.

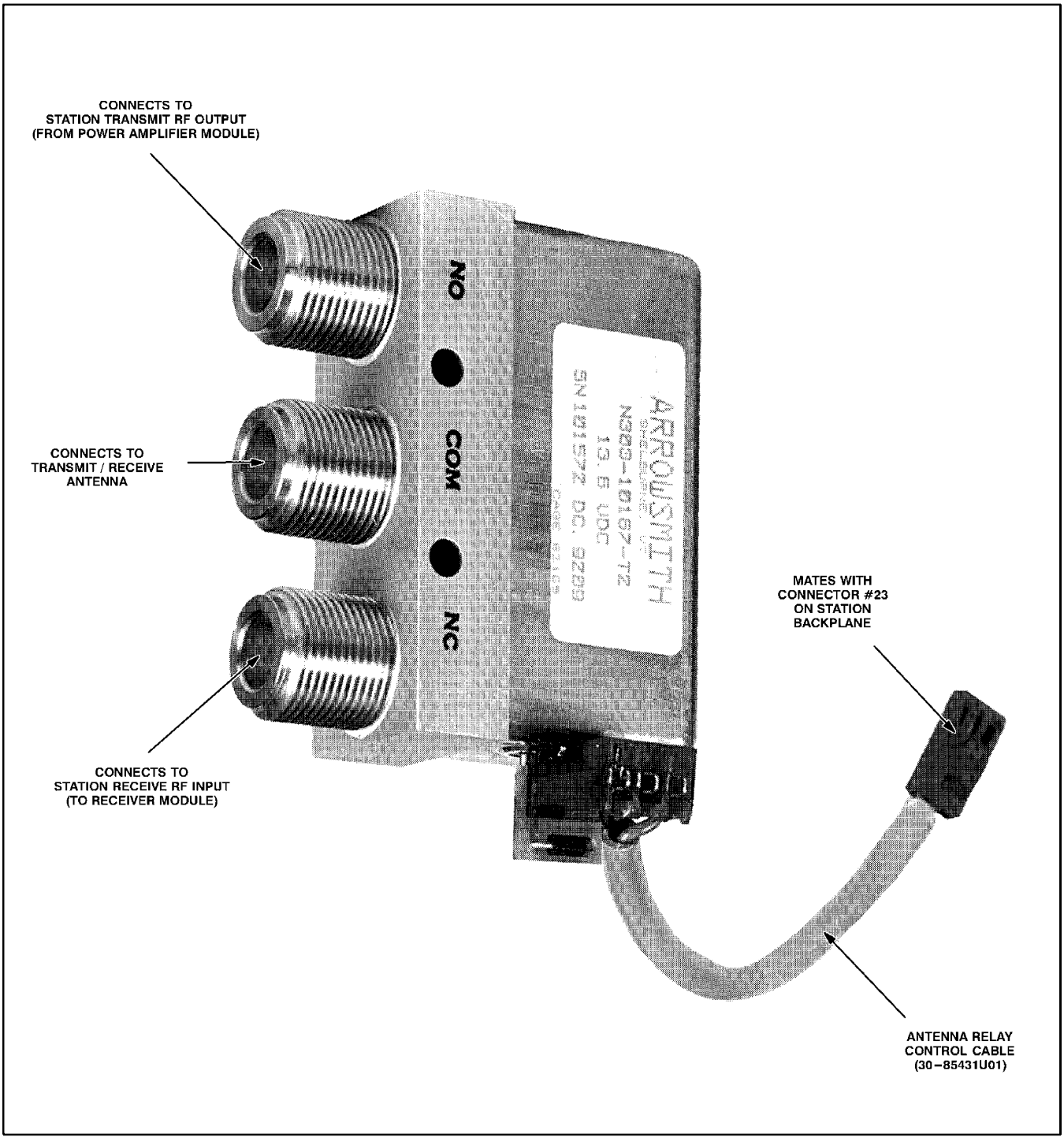

Figure 2. Antenna Relay Module Inputs/Outputs

3 OPTION COMPLEMENT

Table 1 shows the contents for the Option X371AA antenna relay module.

Option Complement Chart

Table 1. Antenna Relay Option X371AA Complement

Model	Description
TRN7664A	Includes miscellaneous hardware and antenna relay module (Motorola Part No. 80−84033T02)

4 PERFORMANCE SPECIFICATIONS

Table 2 shows the electrical performance specifications for the antenna relay used in Options X371AA−AC.

Performance Specifications

Table 2. Performance Specifications for Antenna Relay

Parameter	Specification
Operating Frequency	DC − 4 GHz
Maximum Input Power	500W
Coil Specifications: Pull−in voltage Drop−out voltage Resistance	 9.5V dc 2V dc 100Ω ±10% @ 20°C
Contacts Specifications: Type Actuation Pull−in time Drop−out time	 SPDT Failsafe 20 msec max. 10 msec max.
Insertion Loss	0.30dB max
Isolation	70dB min
VSWR Maximum	1.3 : 1
Temperature Range	−30°C to +80°C
Terminations	Female N−Type
Input and Output Impedance	50 Ohms

5 MOUNTING LOCATIONS

In order to provide alternative routing for the antenna rf cable, the Antenna Relay Module may be installed in two positions on the rf input/output bracket. Stations equipped with the antenna relay module option are shipped with the antenna relay module installed as shown in Figure 3, allowing the rf cable to be routed out the side of the cabinet or rack. If desired, the bracket may be turned 90° counterclockwise to allow the cable to be routed toward the bottom of the cabinet or rack, as shown in Figure 4.

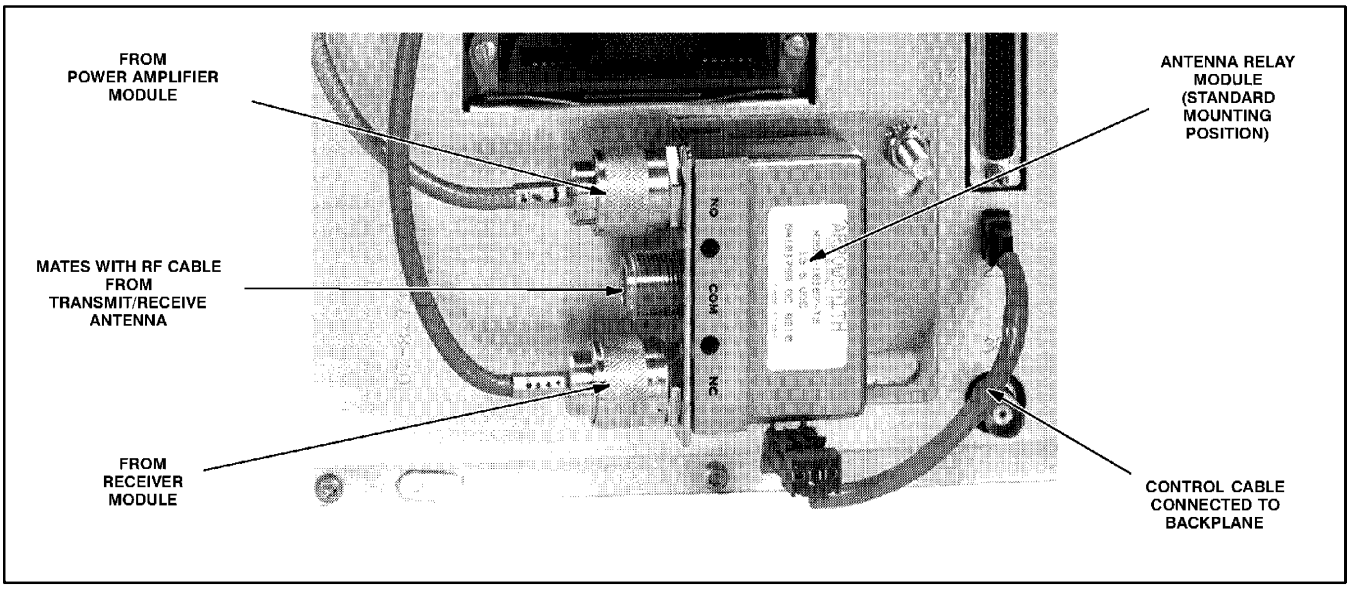

Figure 3. Standard Mounting Position for Antenna Relay Module

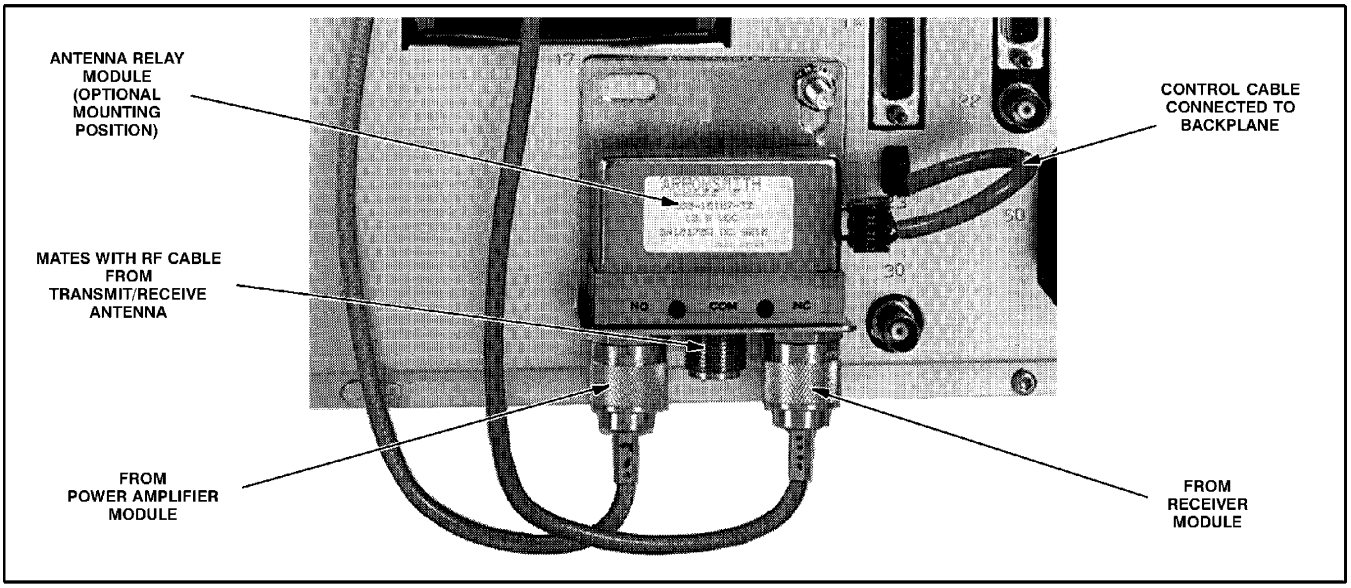

Figure 4. Optional Mounting Position for Antenna Relay Module

6 FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the Antenna Relay Module at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the module in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 5 for a block and interconnect diagram of the Antenna Relay Module.

Functional Operation

Note that with the relay de–energized the antenna is connected to the Receiver Module. To connect the antenna to the Power Amplifier Module, the Station Control Module must energize the relay.

The Antenna Relay Module contains a relay with a set of normally open and normally closed contacts. The relay coil is controlled by a signal from the Station Control Module to connect either the Receiver Module or the Power Amplifier Module to a single transmit/receive antenna. Refer to the block diagram shown in Figure 5.

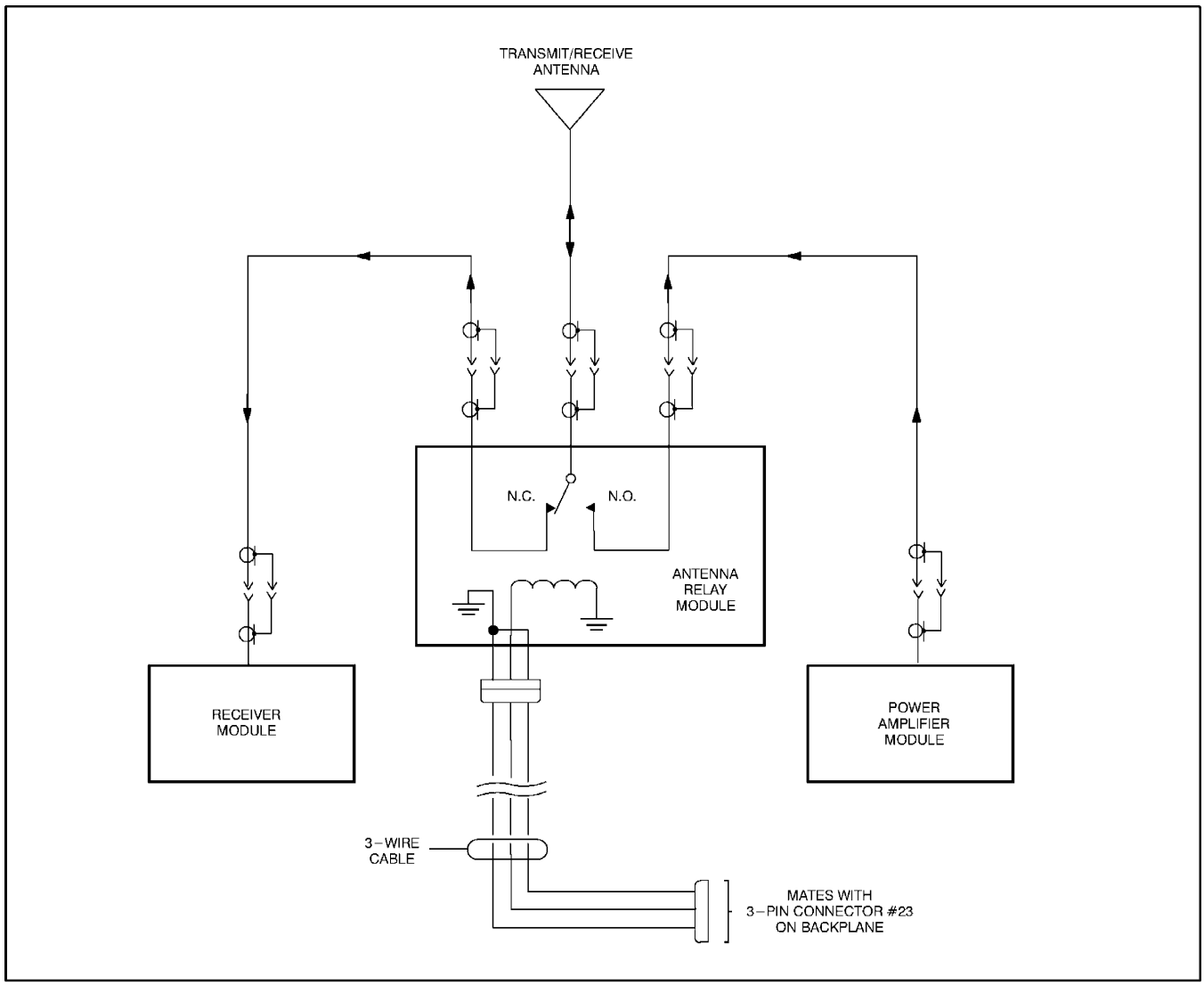

Figure 5. Functional Block and Interconnect Diagram for Antenna Relay Module

MOTOROLA

TRIPLE CIRCULATOR OPTION

(Options X676AA–AC)

1 DESCRIPTION

Options X676AA–AC provide band–specific dual circulator assemblies and low pass filters for use with *Quantar* VHF station. The triple circulator option is comprised of the dual circulator assembly combined with the single circulator located in the station power amplifier module. This combination provides 65 dB (min) of isolation between the Power Amplifier Module and the transmit antenna. A low pass filter connects between the dual circulator output 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, allowing 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 dual circulator assembly consists of two rf circulators and a 50 Ω load with heat sink, all mounted on a 3/16 " aluminum plate which is housed in the Peripheral Tray. The tray is equipped with a cooling fan which directs air across the fins of the heat sink. 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 output of the filter connects to the transmit antenna (directly, via antenna relay module, or via duplexer).

Commercial Government and Industrial Solutions Sector
1301 E. Algonquin Road, Schaumburg, IL 60196

68P81086E34–B
9/1/00–UP

2 OPTIONS COMPLEMENT

Table 1 shows the applications and contents for the available triple circulator options for *Quantar* VHF station.

Option Complement Chart

Table 1. Triple Circulator Options Complement

Option	Application	Option Contents	
X676AA	*Quantar* VHF High Band (132–146 MHz)	TYD4001A TLN3391A TYD4010A TRN7796A	Dual Circulator 50Ω Load w/ heatsink Low Pass Filter Cooling Fan
X676AB	*Quantar* VHF High Band (144–160 MHz)	TYD4002A TLN3391A TYD4010A TRN7796A	Dual Circulator 50Ω Load w/ heatsink Low Pass Filter Cooling Fan
X676AC	*Quantar* VHF High Band (158–174 MHz)	TYD4003A TLN3391A TYD4010A TRN7796A	Dual Circulator 50Ω Load w/ heatsink Low Pass Filter Cooling Fan

3 PERFORMANCE SPECIFICATIONS

Table 2 shows the electrical performance specifications for the dual circulator assembly used for Options X676AA–AC.

Table 3 shows the electrical performance specifications for the low pass filter used in Options X676AA–AC.

Performance Specifications

Table 2. Performance Specifications for Dual Circulator Assembly

Parameter	Specification
Operating Frequency X676AA X676AB X676AC	 132–146 MHz 144–160 MHz 158–174 MHz
Maximum RF Input Power	400W
Insertion Loss	1.25dB max (with low pass filter)
Isolation	45 dB min *(total of 65 dB when combined with circulator built into power amplifier module)*
Operating Temperature Range	–20°C to +70°C
Input/Output Return Loss	19.1 dB min
Terminations	Female N–Type
Input and Output Impedance	50 Ohms
50Ω Load Maximum Power	25W without cooling fan on 90W with cooling fan on
Thermistor Output	50 kΩ @ 25°C 1.7 k Ω @ 125°C

Table 3. Performance Specifications for Low Pass Filter

Parameter	Specification
Operating Frequency	132–174 MHz
Insertion Loss	0.25 dB
Maximum RF Input Power	350W
Rejection	55 dB min (264–600 MHz)

4 INPUTS/OUTPUTS

Figure 1 shows the dual circulator assembly input and output external connections.

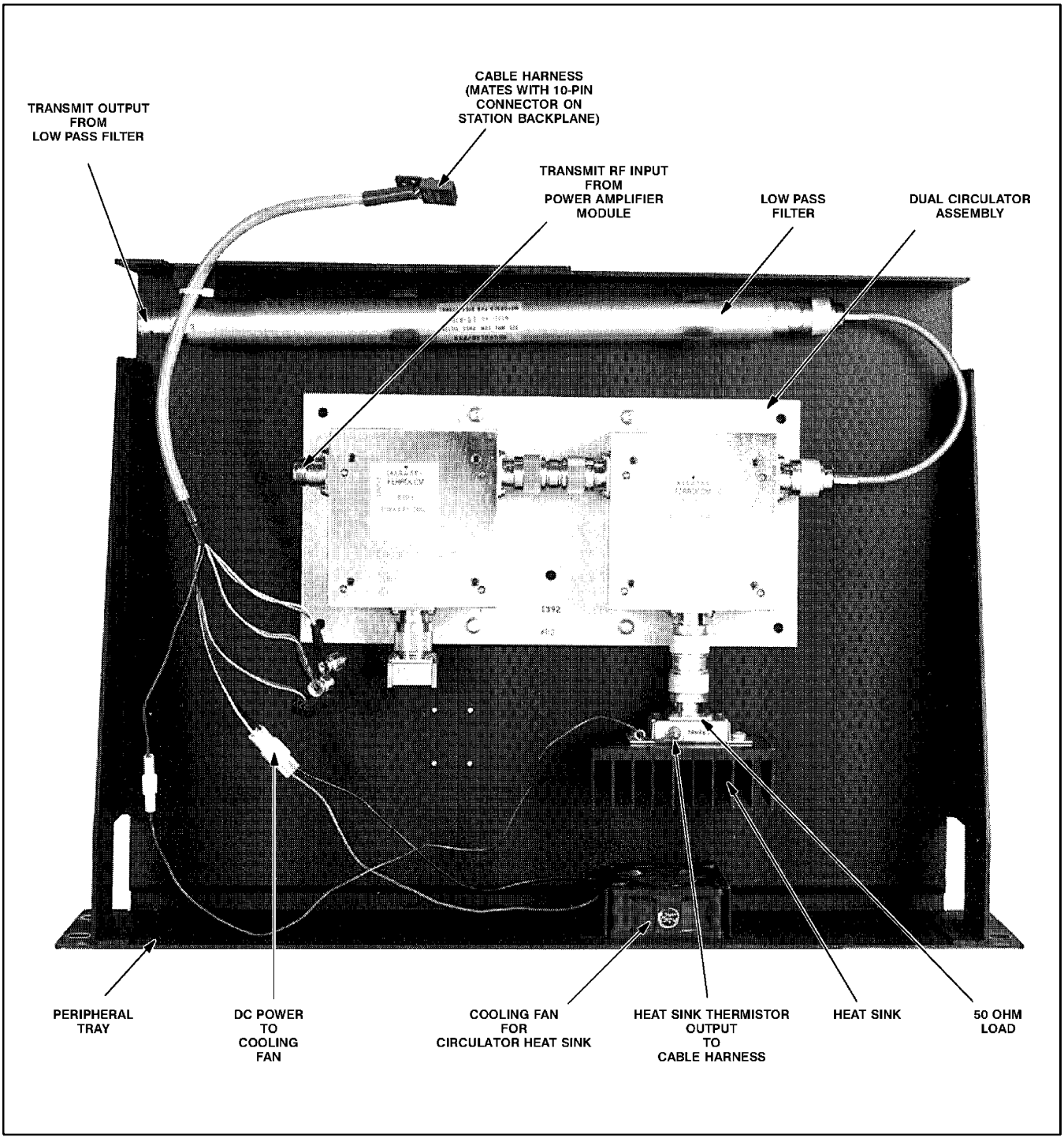

Figure 1. Dual Circulator Assembly and Low Pass Filter (Mounted in Peripheral Tray) Inputs and Outputs

5 FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the Dual Circulator Assembly and Low Pass Filter at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the module in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 5 for a block and interconnect diagram of the Dual Circulator Assembly and Low Pass Filter.

Functional Operation

Note: *The Triple Circulator Option is typically used in high density radio site applications where other co–located transmitters near the frequency of the station can cause I.M. products. The addition of the dual circulator improves I.M. from >30dB$_I$ to >75 dB$_I$. The low pass filter reduces spurious emissions to 90 dBc.*

The Dual Circulator Assembly accepts transmit rf output power from the power amplifier module and provides 45 dB (minimum) of isolation between the power amplifier module and the transmit antenna. The assembly consists of two circulators, 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 5.

Most of the reflected energy is absorbed by the 50Ω load (heat sink mounted) connected to the second circulator. A thermistor mounted on the heat sink provides a variable resistance signal proportional to the heat sink temperature. This signal is routed to the Station Control Module via the Peripheral Tray cabling harness. If the heat sink temperature exceeds a preset threshold, the Station Control Module enables PA cutback mode. If the overtemperature condition persists, the power amplifier is shut down completely.

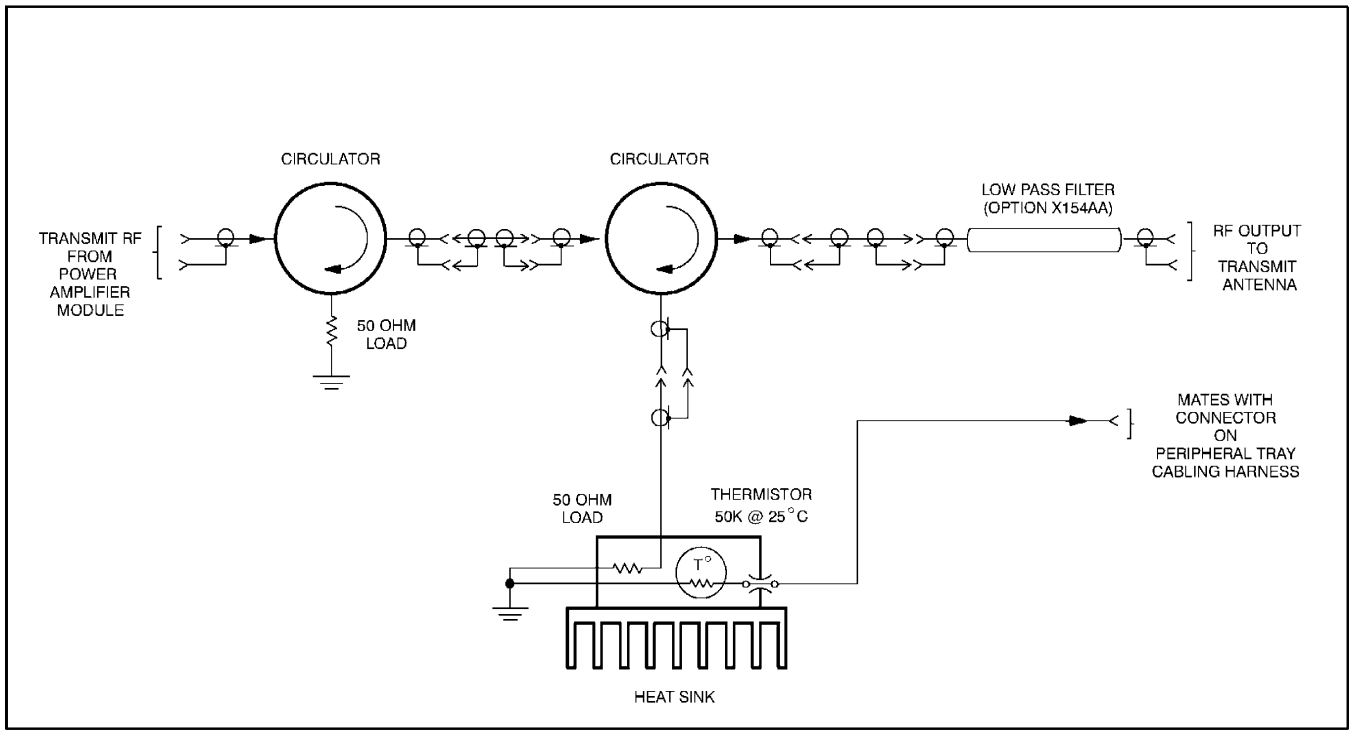

Figure 2. Functional Block and Interconnect Diagram for Dual Circulator Assembly

MOTOROLA

TRIPLE CIRCULATOR OPTION

Options CA00187AA (UHF R0)
X676AN (UHF R1/R2)
X676AP (UHF R3/R4)

1 DESCRIPTION

Options CA00187AA, X676AN, and X676AP provide a dual circulator assembly and low pass filter for use with the *Quantar* UHF station. The triple circulator option is comprised of the dual circulator assembly combined with the single circulator located in the station power amplifier module. This combination provides 65 dB (min) of isolation between the Power Amplifier Module and the transmit antenna. A low pass filter connects between the dual circulator output 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, allowing 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 dual circulator assembly consists of a double rf circulator and a 50 Ω load with heat sink, all mounted on a 3/16 " aluminum plate which is housed in the Peripheral Tray. The tray is equipped with a cooling fan which directs air across the fins of the heat sink. 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 output of the filter connects to the transmit antenna (directly, via antenna relay module, or via duplexer).

Commercial Government and Industrial Solutions Sector
1301 E. Algonquin Road, Schaumburg, IL 60196

68P81088E54–B
8/30/02–UP

2 OPTION COMPLEMENT

Table 1 through Table 3 show the contents of the CA00187AA, X676AN, and X676AP Triple Circulator Options.

Option Complement Charts

Table 1. CA00187AATriple Circulator Option Complement

Option	Option Contents	
CA00187AA	CFX1076A	Dual Circulator
	TLN3391A	50Ω Load w/ heatsink
	TRN7796A	Cooling Fan
	TLE9140A	Low Pass Filter

Table 2. X676AN Triple Circulator Option Complement

Option	Option Contents	
X676AN	TLE9120A	Dual Circulator
	TLN3391A	50Ω Load w/ heatsink
	TRN7796A	Cooling Fan
	TLE9140A	Low Pass Filter

Table 3. X676AP Triple Circulator Option Complement

Option	Option Contents	
X676AP	TLE9130A	Dual Circulator
	TLN3391A	50Ω Load w/ heatsink
	TRN7796A	Cooling Fan
	TLE9140A	Low Pass Filter

3 PERFORMANCE SPECIFICATIONS

Table 2 shows the electrical performance specifications for the dual circulator assemblies used in Options CA00187AA (UHF R0), X676AN (UHF R1/R2), and X676AP (UHF R3/R4). Table 3 shows the electrical performance specifications for the low pass filter used in Options CA00187AA, X676AN, and X676AP.

Performance Specifications

Table 4. Performance Specifications for Dual Circulator Assemblies

Parameter	Specification
Operating Frequency	CA00187AA 380–433 MHz X676AN 403–475 MHz X676AP 475–520 MHz
Maximum RF Input Power	400W
Insertion Loss (with low pass filter and cables)	1.15dB typ 1.6dB max
Isolation	45 dB min *(total of 60 dB when combined with circulator built into power amplifier module)*
Operating Temperature Range	–20°C to +70°C
Input/Output Return Loss	19.1 dB min
Terminations	Female N–Type
Input and Output Impedance	50 Ohms
50Ω Load Maximum Power	25W without cooling fan on 90W with cooling fan on
Thermistor Output	22 kΩ @ 25°C 1.7 k Ω @ 125°C

Table 5. Performance Specifications for Low Pass Filter

Parameter	Specification
Operating Frequency	380–520 MHz
Insertion Loss	0.2 dB
Maximum RF Input Power	500W

4 INPUTS/OUTPUTS

Figure 1 shows the dual circulator assembly input and output external connections.

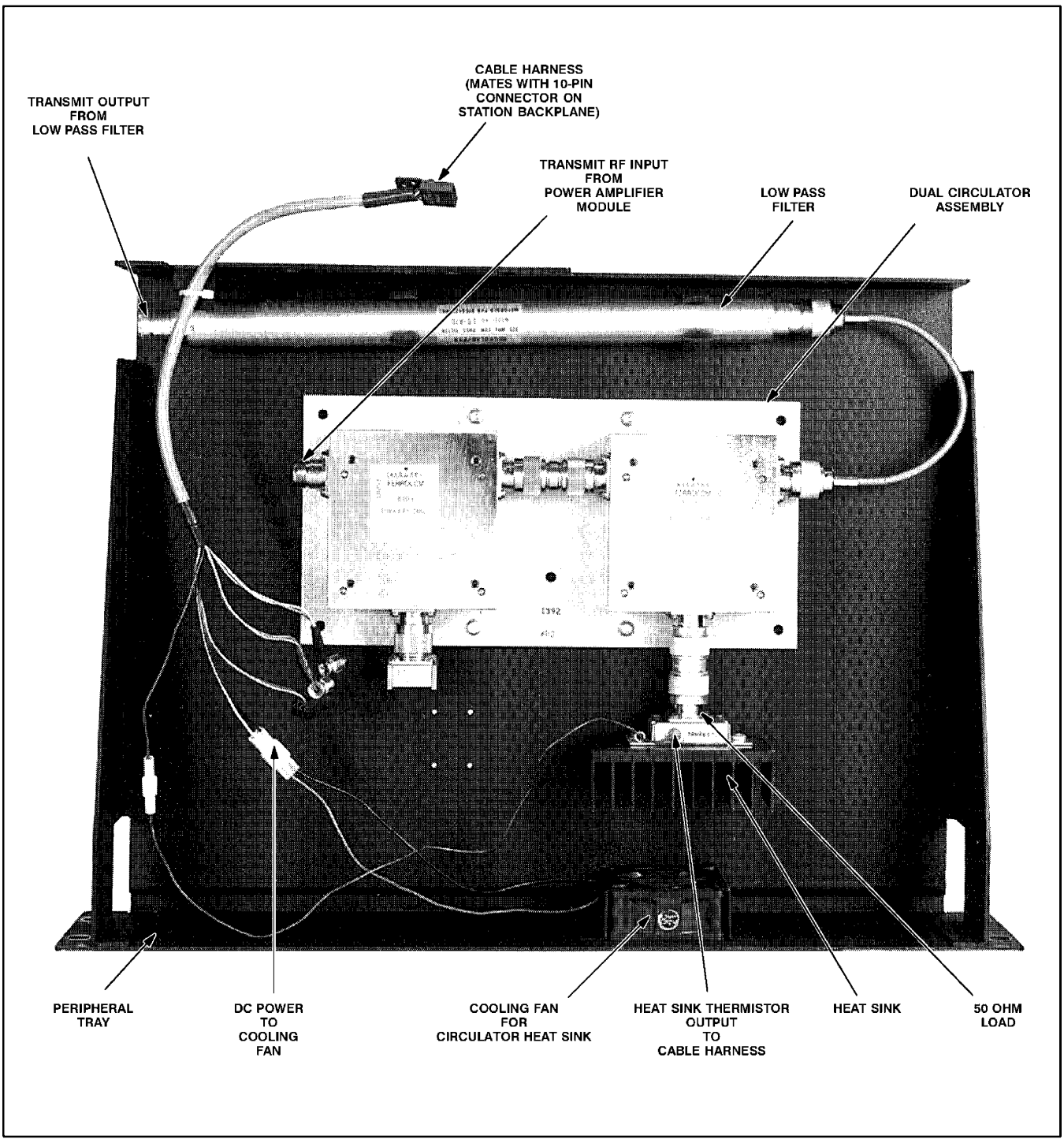

Figure 1. Dual Circulator Assembly and Low Pass Filter (Mounted in Peripheral Tray) Inputs and Outputs

5 FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the Dual Circulator Assembly and Low Pass Filter at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the module in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 5 for a block and interconnect diagram of the Dual Circulator Assembly and Low Pass Filter.

Functional Operation

Note: *The Triple Circulator Option is typically used in high density radio site applications where other co–located transmitters near the frequency of the station can cause I.M. products. The addition of the dual circulator improves I.M. from >20dB$_I$ to >50 dB$_I$. The low pass filter reduces spurious emissions to 90 dBc.*

The Dual Circulator Assembly accepts transmit rf output power from the power amplifier module and provides 45 dB (minimum) of isolation between the power amplifier module and the transmit antenna. The assembly consists of two circulators, 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 5.

Most of the reflected energy is absorbed by the 50Ω load (heat sink mounted) connected to the second circulator. A thermistor mounted on the heat sink provides a variable resistance signal proportional to the heat sink temperature. This signal is routed to the Station Control Module via the Peripheral Tray cabling harness. If the heat sink temperature exceeds a preset threshold, the Station Control Module enables PA cutback mode. If the overtemperature condition persists, the power amplifier is shut down completely.

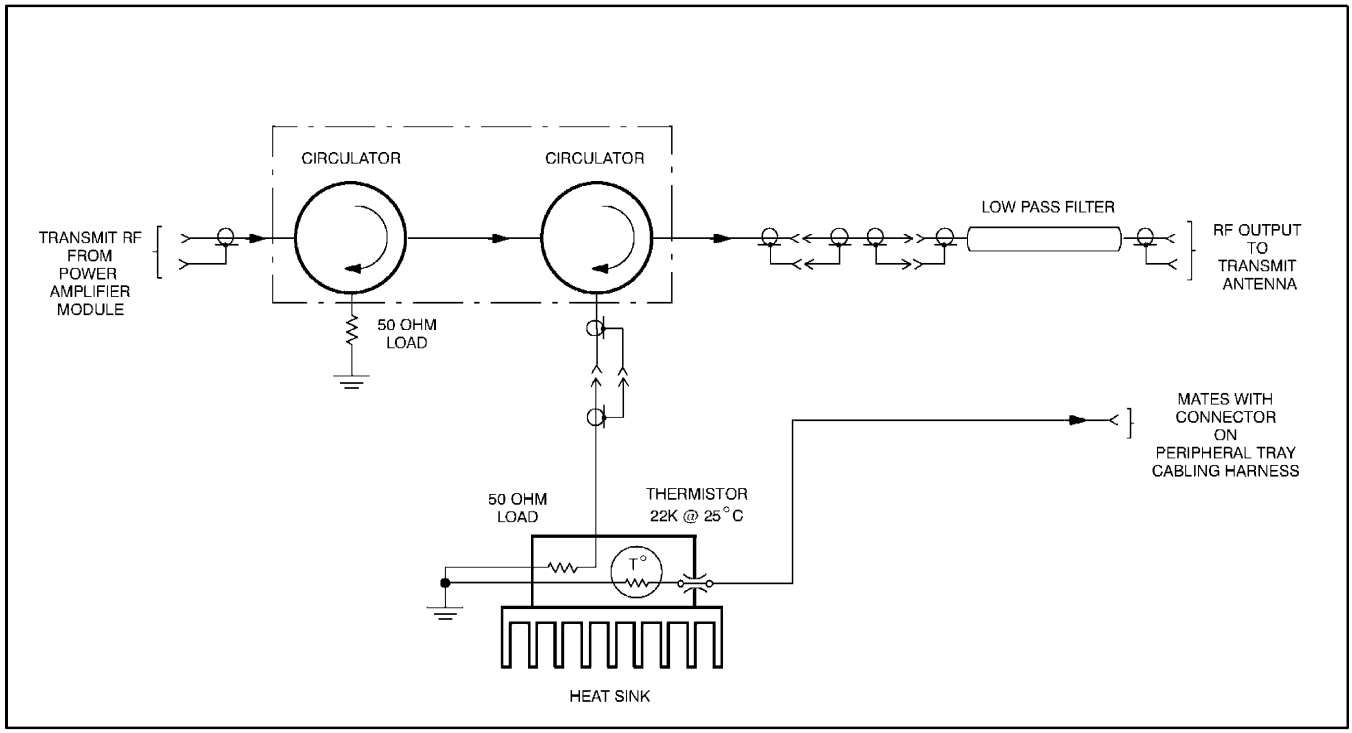

Figure 2. Functional Block and Interconnect Diagram for Triple Circulator Option

MOTOROLA

TRIPLE CIRCULATOR OPTION

Options X676AQ (800 MHz)
X676AR (900 MHz)

1 DESCRIPTION

Options X676AQ and X676AR provide a dual circulator assembly and low pass filter for use with the *Quantar* 800 MHz and 900 MHz stations, respectively. The triple circulator option is comprised of the dual circulator assembly combined with the single circulator located in the station power amplifier module. This combination provides 65 dB (min) of isolation between the Power Amplifier Module and the transmit antenna. A low pass filter connects between the dual circulator output 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, allowing 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 dual circulator assembly consists of a double rf circulator and a 50 Ω load with heat sink, all mounted on a 3/16 " aluminum plate which is housed in the Peripheral Tray. The tray is equipped with a cooling fan which directs air across the fins of the heat sink. 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 output of the filter connects to the transmit antenna (directly, via antenna relay module, or via duplexer).

Commercial Government and Industrial Solutions Sector
1301 E. Algonquin Road, Schaumburg, IL 60196

2 OPTION COMPLEMENT

Table 1 and Table 3 show the contents of the X676AQ and X676AR Triple Circulator Options.

Option Complement Charts

Table 1. X676AQ Triple Circulator Option Complement

Option	Option Contents	
X676AQ	TLF7320A	Dual Circulator
	TLN3391A	50Ω Load w/ heatsink
	TRN7796A	Cooling Fan
	TLF7340A	Low Pass Filter

Table 2. X676AR Triple Circulator Option Complement

Option	Option Contents	
X676AR	TLF7330A	Dual Circulator
	TLN3391A	50Ω Load w/ heatsink
	TRN7796A	Cooling Fan
	TLF7340A	Low Pass Filter

3 PERFORMANCE SPECIFICATIONS

Table 2 shows the electrical performance specifications for the dual circulator assemblies used in Options X676AQ (800 MHz) and X676AR (900 MHz). Table 3 shows the electrical performance specifications for the low pass filter used in Options X676AQ and X676AR.

Performance Specifications

Table 3. Performance Specifications for 800 MHz and 900 MHz Dual Circulator Assemblies

Parameter	Specification
Operating Frequency	X676AQ 850–870 MHz X676AR 935–941 MHz
Maximum RF Input Power	400W
Insertion Loss (with low pass filter and cables)	1.15dB typ 1.6dB max
Isolation	45 dB min *(total of 60 dB when combined with circulator built into power amplifier module)*
Operating Temperature Range	–20°C to +70°C
Input/Output Return Loss	19.1 dB min
Terminations	Female N–Type
Input and Output Impedance	50 Ohms
50Ω Load Maximum Power	25W without cooling fan on 90W with cooling fan on
Thermistor Output	22 kΩ @ 25°C 1.7 k Ω @ 125°C

Table 4. Performance Specifications for Low Pass Filter

Parameter	Specification
Operating Frequency	840–960 MHz
Insertion Loss	0.2 dB
Maximum RF Input Power	500W

4 INPUTS/OUTPUTS

Figure 1 shows the dual circulator assembly input and output external connections.

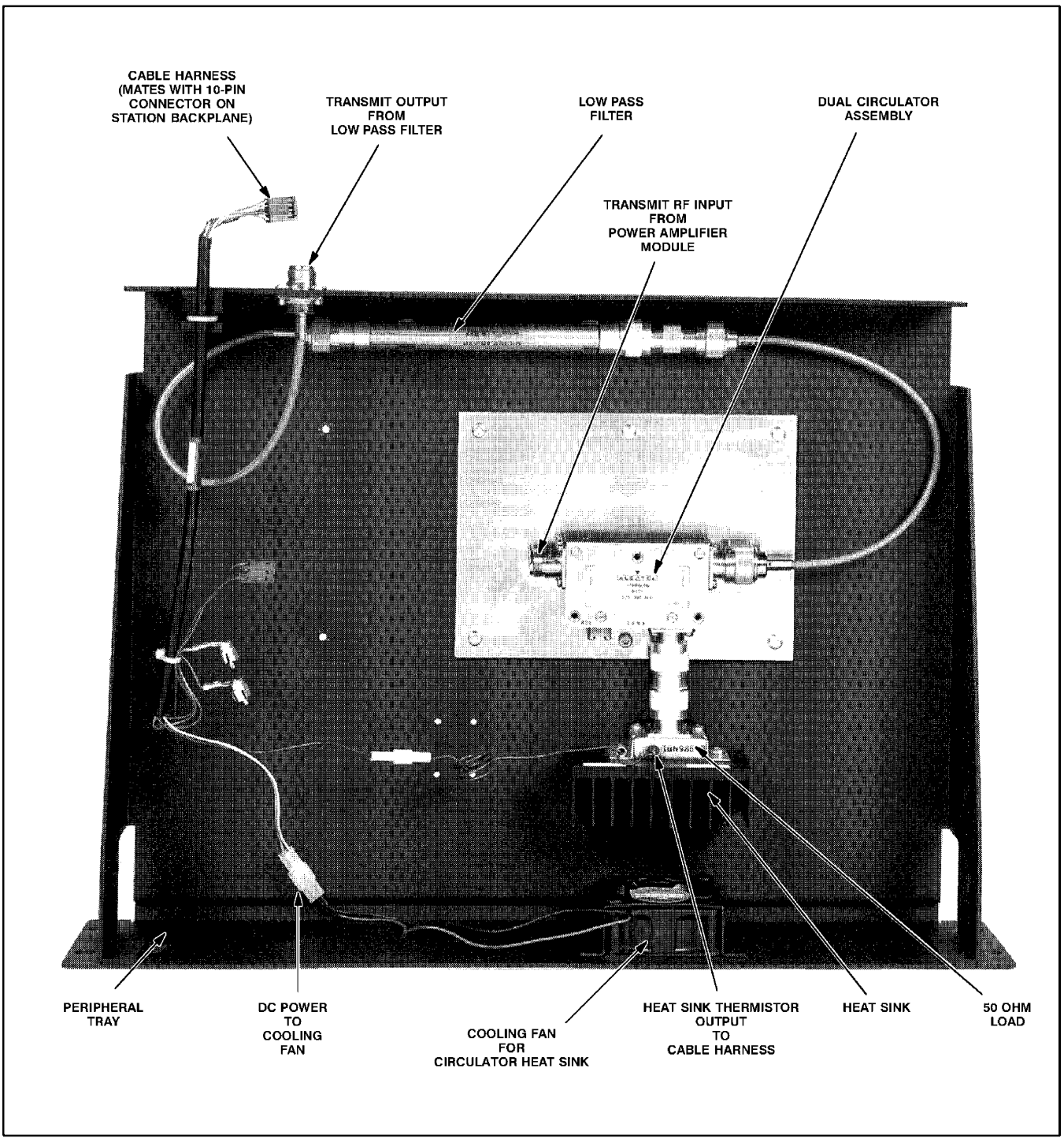

Figure 1. Dual Circulator Assembly and Low Pass Filter (Mounted in Peripheral Tray) Inputs and Outputs

5 FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the Dual Circulator Assembly and Low Pass Filter at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the module in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 5 for a block and interconnect diagram of the Dual Circulator Assembly and Low Pass Filter.

Functional Operation

Note: *The Triple Circulator Option is typically used in high density radio site applications where other co−located transmitters near the frequency of the station can cause I.M. products. The addition of the dual circulator improves I.M. from >20dB$_I$ to >50 dB$_I$. The low pass filter reduces spurious emissions to 90 dBc.*

The Dual Circulator Assembly accepts transmit rf output power from the power amplifier module and provides 45 dB (minimum) of isolation between the power amplifier module and the transmit antenna. The assembly consists of two circulators, 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 5.

Most of the reflected energy is absorbed by the 50Ω load (heat sink mounted) connected to the second circulator. A thermistor mounted on the heat sink provides a variable resistance signal proportional to the heat sink temperature. This signal is routed to the Station Control Module via the Peripheral Tray cabling harness. If the heat sink temperature exceeds a preset threshold, the Station Control Module enables PA cutback mode. If the overtemperature condition persists, the power amplifier is shut down completely.

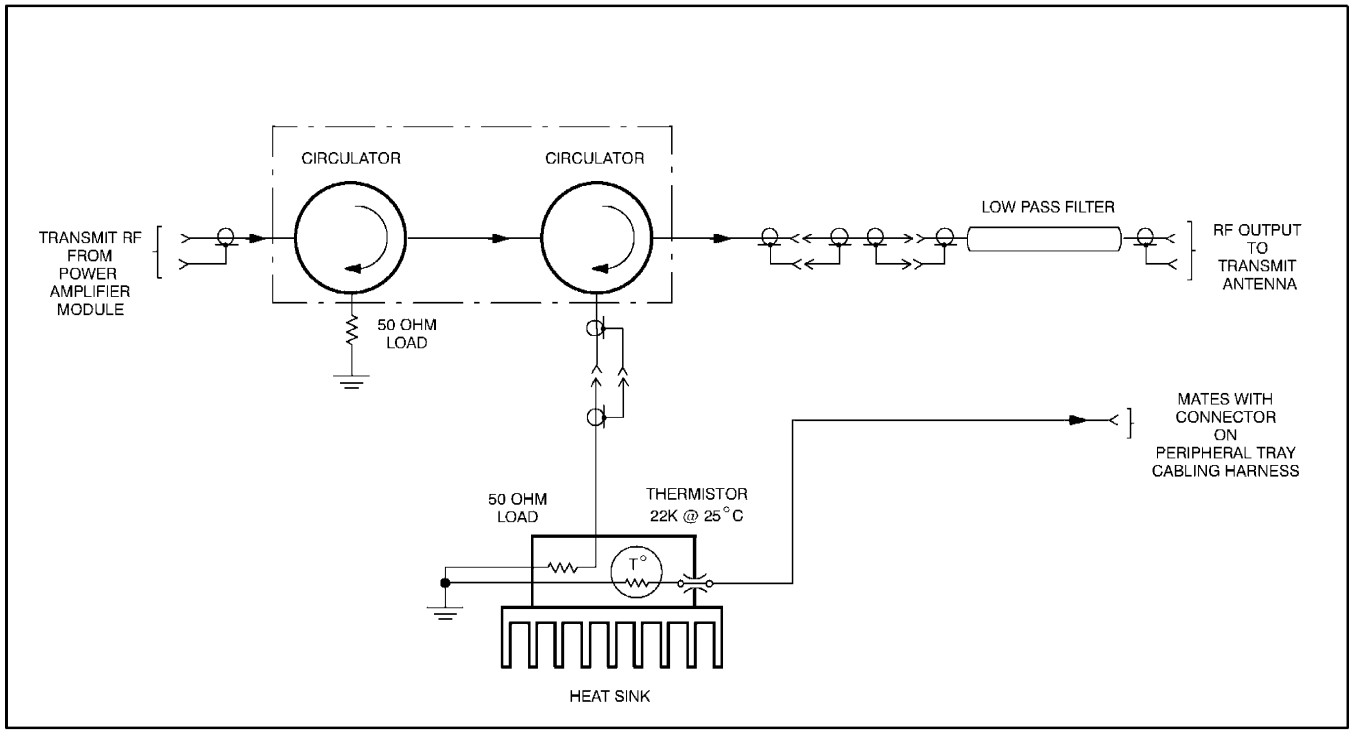

Figure 2. Functional Block and Interconnect Diagram for Triple Circulator Option