

MHT1803 500W Push-Pull Amplifier

User Manual and Operation Guide

Version 1.0

kFuQ

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1 Introduction

1.1 Overview

The MHT1803 500W Push-Pull Amplifier is a high-performance RF power amplifier designed specifically for mobile amateur radio operations. This amplifier utilizes two MACOM MHT1803A/B LDMOS transistors in a push-pull configuration to deliver 500 watts of clean RF power across the 1.8 to 30 MHz frequency range.

1.2 Key Features

- **Power Output:** 500W continuous duty
- **Frequency Range:** 1.8 - 30 MHz (HF bands)
- **Input Power:** 6-8W for full output
- **Modes Supported:** AM, SSB, FM
- **Power Supply:** 12-13.8V DC @ 50A
- **Cooling:** 240mm AIO liquid cooling with custom copper mounting plate
- **Band Selection:** 5-position rotary switch
- **Protection:** Temperature, VSWR, overcurrent, voltage monitoring

1.3 Applications

This amplifier is designed for:

- Mobile/portable amateur radio operations
- Emergency communications
- Contest stations
- DXpeditions requiring high power in compact form

2 Safety Warnings

WARNING - HIGH VOLTAGE AND RF RADIATION

This amplifier operates at dangerous voltages (50V DC) and generates high-power RF radiation. Read all safety information before operation.

2.1 Electrical Safety

- Always disconnect power before servicing
- Use proper grounding techniques
- Ensure adequate ventilation around the unit
- Never operate with cooling system disabled
- Maximum input voltage: 14.0V DC

2.2 RF Safety

- Maintain safe distances from antenna during transmission
- Use proper RF grounding and shielding
- Ensure SWR is below 2:1 before full power operation
- Never transmit without a proper antenna load
- Follow local RF exposure regulations

2.3 Thermal Safety

- Always verify AIO cooler operation before use
- Monitor temperature indicators during operation
- Allow proper cool-down time between transmissions
- Ensure thermal paste is properly applied

3 Installation and Setup

3.1 Unpacking and Inspection

1. Carefully remove the amplifier from packaging
2. Inspect for shipping damage
3. Verify all accessories are included:
 - Main amplifier unit
 - 240mm AIO cooler with radiator and fan
 - 4 AWG power cables (2m)
 - RF coaxial jumpers
 - Mounting hardware
 - This user manual

3.2 Mounting and Placement

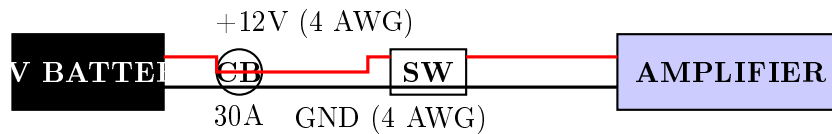
3.2.1 Amplifier Mounting

1. Select a well-ventilated location in your vehicle
2. Ensure at least 6 inches clearance on all sides
3. Mount securely using provided brackets
4. Verify the unit is level and stable

3.2.2 AIO Cooler Installation

1. Mount the 240mm radiator in vehicle roof or external location
2. Ensure adequate airflow through radiator
3. Connect cooling lines to amplifier unit (quick-disconnect fittings)
4. Verify fan operation and proper coolant flow
5. Route cables away from RF paths

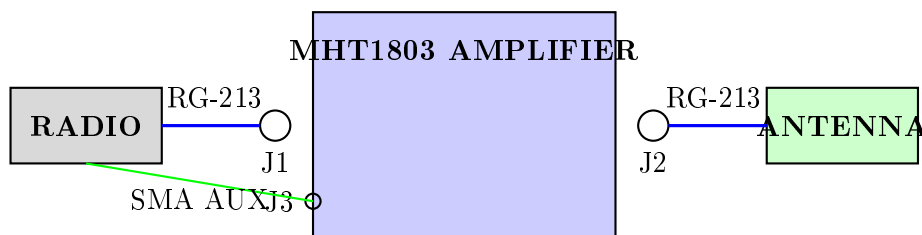
3.3 Power Connections



Power Connection Procedure:

1. Install 30A circuit breaker (CB1) in positive line near battery
2. Route 4 AWG cables through vehicle using proper cable management
3. Connect to amplifier screw terminals (J4):
 - Terminal 1: +12V (Red wire)
 - Terminal 2: Ground (Black wire)
4. Verify all connections are tight (torque to 8 Nm)
5. Test with multimeter before first power-up
6. If circuit breaker trips:
 - Disconnect power immediately
 - Check for short circuits or overload conditions
 - Verify DC-DC converter and power supply connections
 - Reset circuit breaker only after resolving the issue

3.4 RF Connections

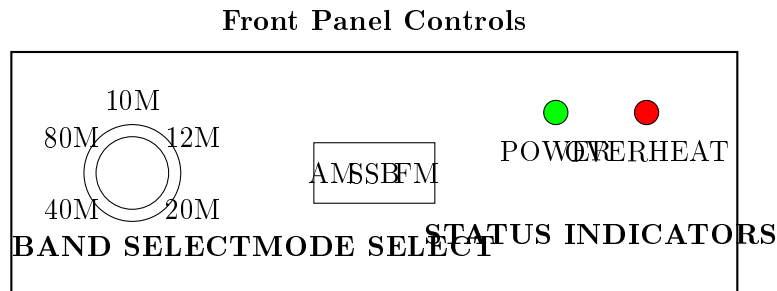


RF Connection Procedure:

1. Connect radio output to J1 (SO-239 Input) using RG-213 coax
2. Connect J2 (SO-239 Output) to antenna system using RG-213 coax
3. Optional: Connect auxiliary radio to J3 (SMA connector)
4. Verify all connections are tight and weatherproofed
5. Check SWR with antenna analyzer before operation

4 Operation

4.1 Control Panel Layout



4.2 Pre-Operation Checklist

1. Verify AIO cooler is operating (fan spinning, coolant flowing)
2. Check power connections are secure
3. Confirm antenna SWR is acceptable (<2:1)
4. Set band selector to operating band
5. Set mode selector to desired mode (AM/SSB/FM)
6. Verify radio is set to low power (6-8W output)

4.3 Power-Up Sequence

1. Turn on AIO cooler system first
2. Wait 30 seconds for coolant circulation
3. Switch on main power (Power LED should illuminate green)
4. Allow 2-minute warm-up period
5. Check that Overheat LED remains off
6. Amplifier is ready for operation

4.4 Operating Procedure

4.4.1 Band Selection

Rotate the 5-position band selector switch to match your operating frequency:

- **Position 1:** 80 meters (3.5-4.0 MHz)
- **Position 2:** 40 meters (7.0-7.3 MHz)
- **Position 3:** 20 meters (14.0-14.35 MHz)
- **Position 4:** 12 meters (24.89-24.99 MHz)
- **Position 5:** 10 meters (28.0-29.7 MHz)

4.4.2 Mode Selection

Set the 3-position mode switch according to your transmission mode:

- **AM:** Amplitude Modulation (carrier + sidebands)
- **SSB:** Single Sideband (USB/LSB)
- **FM:** Frequency Modulation (repeater operation)

4.4.3 Transmission

1. Verify band and mode settings are correct
2. Ensure radio output power is set to 6-8 watts
3. Key the radio briefly (1-2 seconds) to verify operation
4. Monitor Power LED (should remain green)
5. Monitor Overheat LED (should remain off)
6. Proceed with normal operation

4.5 LED Status Indicators

LED	Status	Meaning
Power (Green)	ON	Normal operation, DC power OK
Power (Green)	OFF	No DC power or circuit breaker tripped
Power (Green)	Blinking	DC voltage low (<11V)
Overheat (Red)	OFF	Temperature normal (<85°C)
Overheat (Red)	ON	Overtemperature protection active
Overheat (Red)	Blinking	Coolant flow or pump fault

4.6 Protection Features

The amplifier includes comprehensive protection circuits:

- Temperature monitoring with three LM35 sensors
- YF-S201 coolant flow monitoring
- Input voltage monitoring (LM339)
- Current monitoring (ACS712-30A)
- VSWR protection with PDC10-1 RF detector
- Watchdog timer (555-based)
- Fault latching with CD4043B

5 Troubleshooting

5.1 No Power (Power LED Off)

Possible Causes and Solutions:

- **Circuit breaker tripped:** Check and reset 30A circuit breaker
- **Loose connections:** Verify all power connections are tight
- **Low battery voltage:** Check battery voltage (should be >11V)
- **Faulty power switch:** Test switch continuity

5.2 Overheat LED On

Immediate Actions:

1. Stop transmitting immediately
2. Verify AIO cooler operation
3. Allow amplifier to cool for 10 minutes
4. Check for blocked airflow

Possible Causes:

- AIO cooler pump failure
- Radiator airflow blockage
- High ambient temperature
- Excessive duty cycle
- Thermal paste degradation

5.3 No RF Output

Check the following:

- Input drive level (should be 6-8W)
- Band selector position
- Antenna SWR (<2:1)
- RF connections are secure
- Mode selector setting matches radio

5.4 Reduced Power Output

Possible Causes:

- Low input drive power
- High SWR
- Thermal limiting
- Low supply voltage
- Component aging

5.5 Error Codes and Diagnostics

LED Pattern	Code	Problem
Power: 1 blink, pause	E01	Input undervoltage ($<11V$)
Power: 2 blinks, pause	E02	Current limit exceeded
Power: 3 blinks, pause	E03	VSWR protection
Overheat: Fast blink	E04	Coolant flow fault
Both LEDs alternating	E05	Multiple faults active

6 Maintenance

6.1 Routine Maintenance Schedule

6.1.1 Monthly Checks

- Check AIO cooler pump operation
- Verify coolant flow sensor readings
- Inspect radiator for dust/debris
- Check all power connections
- Clean external surfaces
- Test protection circuits

6.1.2 Quarterly Maintenance

- Clean radiator fins thoroughly
- Check coolant level and condition
- Inspect all cooling system hoses
- Test temperature sensors
- Verify flow sensor calibration
- Check mounting hardware

6.1.3 Annual Service

- Replace Arctic Silver 5 thermal compound
- Flush and refill cooling system
- Clean copper mounting plate
- Full system calibration
- Comprehensive protection testing

6.2 Cooling System Maintenance

1. Keep radiator fins clean and unobstructed
2. Monitor coolant color for contamination
3. Check all hose connections monthly
4. Verify pump operation before each use
5. Replace coolant annually or if discolored
6. Clean copper mounting plate during thermal paste replacement

6.3 Cleaning Procedures

1. Disconnect all power before cleaning
2. Use only isopropyl alcohol and lint-free cloths
3. Avoid getting moisture in connectors or controls
4. Allow to dry completely before reconnecting power

6.4 Storage Recommendations

- Store in dry, temperature-controlled environment
- Protect connectors with caps
- Drain AIO cooler if storing below freezing
- Check condition every 6 months during storage

7 Technical Specifications

7.1 RF Performance

Parameter	Specification
Frequency Range	1.8 - 30 MHz
Power Output	500W continuous
Input Power	6 - 8W
Gain	18 - 19 dB
Efficiency	>65%
Harmonics	<-40 dBc
Spurious	<-50 dBc
Input VSWR	<1.5:1
Output VSWR Tolerance	3:1 maximum

7.2 Electrical Specifications

Parameter	Specification
Supply Voltage	12 - 13.8V DC
Current Consumption (Idle)	2.5A
Current Consumption (Full Power)	50A
Internal Voltage	50V DC
Power Consumption	690W maximum

7.3 Physical Specifications

Parameter	Specification
Dimensions (W×H×D)	220 × 80 × 180 mm
Weight	3.2 kg
Operating Temperature	-10°C to +50°C
Storage Temperature	-40°C to +70°C
Humidity	0-95% non-condensing
Cooling	240mm AIO liquid cooling

7.4 Connectors and Controls

Connector	Type	Function
J1	SO-239	RF Input (from radio)
J2	SO-239	RF Output (to antenna)
J3	SMA	Auxiliary RF Input
J4	Screw Terminal	12V DC Power Input
SW1	Rotary (1P5T)	Band Selection
SW2	Slide (1P3T)	Mode Selection
D1	LED (Green)	Power Indicator
D2	LED (Red)	Overheat Indicator

8 Technical Support

For technical support or to report issues:

1. Visit our GitHub repository at <https://github.com/kfuq/MHT1803-500W-Amp>
2. Click on the "Issues" tab
3. Click "New Issue"
4. Select the appropriate issue template:
 - Bug Report - for operational problems
 - Feature Request - for enhancement suggestions
 - Build Help - for assembly questions
 - Technical Support - for general assistance
5. Fill out all required information in the template
6. Include detailed descriptions and photos if applicable
7. Submit the issue

When reporting issues, please include:

- Detailed description of the problem
- Operating conditions when the issue occurred
- LED status indicators at time of failure
- Any error codes displayed
- Photos or videos demonstrating the issue

- Steps you've already taken to troubleshoot

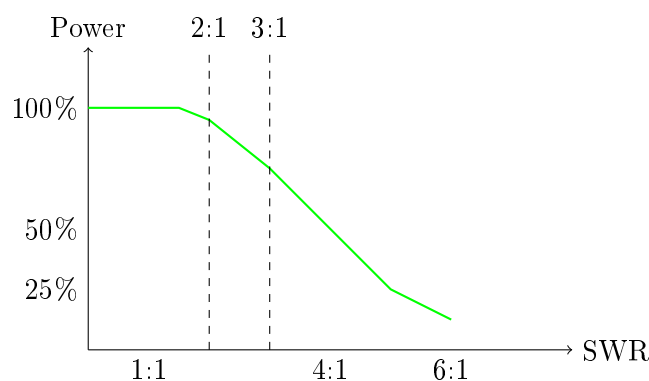
Our support team monitors GitHub issues during normal business hours (Monday-Friday, 8 AM - 5 PM EST).

9 Appendices

9.1 Appendix A: Band Plan Reference

Band	Frequency	Wavelength	Typical Use
80 meters	3.5 - 4.0 MHz	80m	Regional/DX
40 meters	7.0 - 7.3 MHz	40m	Regional/DX
20 meters	14.0 - 14.35 MHz	20m	Worldwide DX
12 meters	24.89 - 24.99 MHz	12m	Sporadic E
10 meters	28.0 - 29.7 MHz	10m	Skip/Local

9.2 Appendix B: SWR Chart



9.3 Appendix C: Parts List for User Serviceable Items

Item	Part Number	Description
CB1	CB-30A-32V	30A Automotive Circuit Breaker
TH1	NTC-10K-B3977	10K NTC Thermistor
Thermal Paste	MX-4-4G	Arctic MX-4 Thermal Compound
Coolant	CL-CLEAR-1L	AIO Coolant (Clear)

10 RF Matching Networks

The amplifier includes dedicated RF matching networks for each supported band (80m, 40m, 20m, 12m, and 10m). These networks are designed to provide optimal impedance matching between the RF input and the amplifier stages, ensuring maximum power transfer and efficiency.

10.1 Matching Network Selection

The matching networks are automatically selected based on the band selection switch position. Each network is optimized for its specific band and includes:

- Input impedance matching for 50 to the amplifier input impedance
- Output impedance matching for the amplifier output to 50
- Band-specific filtering to reduce harmonics

10.2 Tuning and Adjustment

The matching networks are factory-tuned and should not require adjustment. However, if modification is necessary:

1. Ensure the amplifier is powered off and disconnected
2. Remove the top cover to access the matching networks
3. Use a network analyzer to measure the input/output impedance
4. Adjust the matching components as needed
5. Verify the VSWR is below 1.5:1 across the band

11 VSWR Protection

The amplifier includes a comprehensive VSWR protection circuit to prevent damage from high reflected power conditions.

11.1 Protection Features

The VSWR protection circuit provides:

- Real-time monitoring of forward and reflected power
- Automatic power reduction when VSWR exceeds 2:1
- Complete shutdown if VSWR exceeds 3:1
- Visual indication of protection activation

11.2 Protection Circuit Operation

The protection circuit operates as follows:

1. Continuously monitors the RF output
2. Compares forward and reflected power levels
3. Activates protection if VSWR threshold is exceeded
4. Automatically resets when conditions return to normal

12 EMI Filtering

The amplifier includes comprehensive EMI filtering to ensure compliance with regulatory requirements and prevent interference with other equipment.

12.1 Filter Components

The EMI filter circuit consists of:

- Input line filter for power supply
- RF output filtering
- Ferrite bead suppression
- Decoupling capacitors

12.2 Filter Maintenance

To maintain proper EMI filtering:

1. Keep all filter components clean and dry
2. Check for physical damage during regular maintenance
3. Verify filter effectiveness during annual testing
4. Replace damaged or degraded components immediately

END OF MANUAL

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