



User Manual
[BPA00T10W500-1]

Please read this manual before using the equipment.
And keep this manual with the equipment.

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1. General

1.1. Information about this User Manual

This user manual is a part of the BPA00T10W500-1 broadband amplifier system of L2 Microwave Corporation and describes the design, function, operation and components of the broadband amplifier system. The terms of the model BPA00T10W500-1, broadband amplifier, and broadband amplifier system are used as synonyms in this user manual.

Contents

The user manual for the broadband amplifier system describes all the required activities for the installation, operation, and diagnostic procedures of the broadband amplifier.

Safety

All skilled personnel working with the broadband amplifier system or its components must read the relevant information and follow the safety instructions outlined in the user manual. The broadband amplifier must be used according to the operational purposes and regulations, and all operations associated with the broadband amplifier or individual components must be performed by skilled personnel. Any additional skills and qualifications are referenced in the appropriate sections in the manual.

Symbol



This triangle symbol means danger. Caution should be exercised if you do not follow this manual correctly or do not comply with it, this may damage the equipment. Do not proceed to the next step until you fully understand and meet the indicated conditions.



This triangle symbol means caution. This equipment is a Class 1 safety ground product (provided the protective earth included in the power cord). Only the line power plug should be inserted into the outlet provided with the protective earthing contact. Damage to the protective conductor inside or outside may expose the product to hazards and should not intentionally damage the protective conductor.

If you have specific instructions, they are numbered and contain additional information for easier handling and processing of the broadband amplifier system.

1.2. Purpose of Operation

- The BPA00T10W500-1 is used to amplify electrical input signals with frequencies and powers that meet the limits specified in the technical specifications.
- All interfaces are used to connect external devices, the inputs and outputs of which correspond to the requirements of the respective interface specifications provided in the technical specifications, please refer to the data sheet of the BPA00T10W500-1.
- The BPA00T10W500-1 should only be used under the environmental conditions specified in the technical specifications.

This type of system should only be operated by qualified personnel and require a high level of accountability to ensure proper operation, understanding of technical complexity, and the ability to safely cope with potential risks. Examples of applications that can be used include.

- RF amplifiers that produce high field strength through radiation antennas for EMC measurements, materials, and device testing in fully shielded chambers.
- RF amplifier for energy generation for particle acceleration.
- RF amplifiers for feeding magnetic field coils.

1.3. Responsibility of the Operator

Operator

The operator is the company/institution that operates the instrument for its own commercial or scientific purposes or makes it available for use/usage to third parties and holds the legal product liability for protecting the user, personnel or third party during operation.

Obligations of the operator

The broadband amplifier is used in commercial applications, and operators of the broadband amplifier are subject to legal obligations for industrial safety. In addition to the safety instruction in this manual, the regulations for safety, accident prevention, hygiene and environmental protection must be observed. In particular, the following applies.

- The operator shall be familiar with their workplace safety regulations and risk assessment to identify the risks that may arise from the specific operating conditions of the site where the broadband amplifier is used. Appropriate operating instruction for operating the broadband amplifier should also be prepared to prevent hazards.
- The operator shall periodically check that operational instructions created in accordance with the rules during the entire operating time of the broadband amplifier meet current regulatory requirements. The operator shall modify the operating instructions when any changes are made.

The operator shall also be responsible for ensuring that the broadband amplifier and all systems connected to the instrument are always in perfect working order. Therefore, the following applies.

- The operator shall be obligated to have all safety devices that are connected to the system checked regularly for proper function and completeness.
- The operator of broadband amplifier system is responsible for ensuring the safe working conditions of the personnel.
- The operator must comply with the maintenance period described in this manual.

When an operator enters or exits a room where high field strengths occur, the RF interlock system and personal RF warning devices must be used to protect against the risk of radiated RF power.

1.4. Specifications

ELECTRICAL SPECIFICATIONS @ 220VAC, 25°C, 50Ω

Parameter	Symbol	Min	Typ	Max	Unit
Operating Frequency	BW	80		1000	MHz
Output Power @ P _{SAT} , CW	P _{SAT}	500	600		Watt
Power Gain @ Psat	G _S	57	60		dB
Input Power for Rated P _{SAT}	P _{IN}		0		dBm
Gain Flatness @ Rated P _{SAT}	ΔG		±1.5		dB
Input Return Loss	S11			-10	dB
In/Out Impedance	Z		50		ohm
Third Order Intercept Point 2-Tones @ 47dBm/Tone, Δ = 100 kHz	IP3		+62		dBm
Harmonics @ Pout =250W	2 nd / 3 rd		-20	-16	dBc
Spurious Signals	Spur		-70	-60	dBc
Power consumption @ P _{SAT}	VAC		2800	3500	Watt

MECHANICAL SPECIFICATIONS

Parameter	Value	Units	Note
Dimensions (H x W x D)	310.5 x 441 x 606.9	mm	7U
Weight	60	kg	Max
RF Connectors Input/Output	N type, Female		Front
Primary Power	88~264 VAC, 50/60Hz 3 pin Single phase		
Cooling	Air cooling Self-contained fans & Heat sink		

ENVIRONMENTAL CHARACTERISTICS (Design to Meet)

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	Tc	-10		+60	°C
Storage Temperature	Tstg	-40		+85	°C
Relative humidity (non-condensing)	RH			95	%
Altitude (MIL-STD-810F Method 500.4)	ALT			30,000	Feet
Vibration/Shock MIL-STD-810F-Method 514.5/516.5-Proc I	VI/SHI		Airborne		

FUNCTION

Parameter	Condition	Note
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Input RF drive level without damage	+3dBm	
Shut Down	Over Power @ typ. Psat + 2dB	TBD
	Over Current Shutdwon	Indication LED
	Over Temperature 70°C Shutdown	Indication LED
AMP on / off	Push Button	Front

2. Safety

2.1. Basic Safety Instructions

Chapter 1 "General" of this manual contains "Basic Safety Instructions" that apply to all products produced and supplied by L2 Microwave. The BPA00T10W500-1 broadband amplifier system and its ancillary equipment must only be operated by qualified technicians.

Compliance with all legal provisions is a prerequisite for operating the broadband amplifier. The operator or agent authorized by the operator is responsible for complying with these instructions. And training for authorized representatives must meet local requirements.

2.2. Product-specific Safety Instructions

2.2.1. Safety Instruction for Amplifier System and Equipment

- Only trained personnel can perform electrical installation and connection tasks.
- When installing an operating area and installing or operating electrical equipment, always comply with the relevant national and international safety rules and regulations.
- When installing an amplifier rack, it is important to comply with national special accident prevention.

2.2.2. Hazards from Supply Voltage

Risk of fatal injury from electrical voltage



- When working with voltages that constitute a shock hazard, appropriate measures must be taken to prevent exposure to danger.

2.2.3. Power Supply

Risk of property damage

Operation without protection against overloads and short circuits can lead to damage to the instrument, fire, or arcing.

- Before connecting the power supply, it is important to ensure that the system or the power supply specifications applied to the equipment comply with the general specifications of the local power supply network.
- The power supply device must be protected at all times through a fuse or an earth leakage power breaker to prevent overload and short circuit.
- If the equipment is permanently connected to the power supply without a power plug, install a device that will power off the power supply circuit at all poles.

2.2.4. High energy electrical circuits

Electrical circuits carrying high amounts of energy pose a risk of injury.



This equipment has a low voltage circuit that can be supplied from an extremely low impedance voltage source (e.g. amplifier operating voltage). These circuits carry dangerously high levels of energy.

These electrical circuits are considered circuits with hazardous contact voltages. Therefore, the user should always be careful about electrical contacts.

2.2.5. Hazards from high-frequency currents

Burn hazard from arcing



All of the power-conducting RF plug connectors and RF modules require attention to contact current. Arcing may occur if high-frequency cables are plugged in or unplugged while the amplifier is in operation. This can cause burns and eye injuries. At open high-frequency interfaces with active gain there is a burn hazard in the high-frequency range and risk of electric shock in the low-frequency range.

- Operate the amplifier system after firmly fixing the antenna or load.
- Never disconnect the high frequency cable while the amplifier system is in operation.
- Never open the amplifier system while it is in operation.
- Never operate the amplifier system if the RF cables are exposed.

2.2.6. Hazards from RF Radiation

Risk of injury from high-frequency electromagnetic radiation

High frequency electromagnetic radiation during operation of the broadband amplifier can be generated in the beam portion of the antenna with a specific absorption rate that is higher than the human exposure limits. Prolonged exposure may cause eye damage and metabolic disorders.

Operate the amplifier system only in such a way that the beam area of the antenna is located in a shielded, access-restricted room or area.

2.2.7. Occupational safety from RF shielding

The BPA00T10W500-1 broadband amplifier system is shielded from all RF cables, shielding covers and case components to ensure that they are not exposed to RF radiation even if they are close together for extended periods of time. This industrial safety clause is based on Korean legislation.

2.2.8. Flue gases

Severe health damage may be caused by flue gas formation.

In general, any flue gases produced by burning of casing parts, cables, insulation materials, batteries, etc. can result in serious harm to a person's health.

- Use personal protective equipment in the event of smoke formation. Use breathing protection in the danger zone that is independent of the ambient air.

2.2.9. Rules for amplifier services

Do not operate the amplifier system (equipment) unless the case is closed.

Risks when reconnecting the power supply

Do not reconnect the power supply until the amplifier is fully installed. Failure to observe this may result in electric shock or RF radiation.

- Ensure that all case components are securely installed.
- Ensure that all cables and grounding lines are properly connected.

2.3. Operator (Personnel/User)


Risk of injury from insufficient qualification of personnel

All work (operation, maintenance, troubleshooting, repair, etc.) should be performed only by qualified personnel. Failure to do so may result in serious injury or property damage.

2.4. Safety Devices

2.4.1. Protective Covers

Risk of injury due to removed protective covers

 This symbol indicates a protective cover for electrical circuits at risk due to large amounts of energy, RF current or supply voltage. The protective cover prevents unintentional contact with these electrical circuits.

- Pay attention to the cover marked with this symbol.
- Do not remove the protective cover with this symbol.
- Any work that requires accessing the inside of the system may be carried out by the manufacturer's service personnel only.

2.4.2. Instructions for Protection against Electrostatic Discharge (ESD)

Risk of damage to electronic components

To avoid damage to electronic components, all work on the equipment and components must be performed in a location protected against electrostatic discharge (ESD). The following items can be used individually or in combination to protect against electrostatic discharge.

- Protective armband with grounding cable
- Wearing antistatic shoes and antistatic clothes

3. Installation

This chapter describes the installation of the BPA00T10W500-1 broadband amplifier and the requirements for the peripheral infrastructure.

3.1. Installation Position Selection

RF Radiation

The BPA00T10W500-1 is a broadband amplifier that generates electromagnetic waves and may affect other sensitive equipment; therefore, should only be operated in an industrial environment.

Installation position

This equipment uses air circulation cooling method using FAN to release heat by high power operation. Therefore, we recommend installation in a spacious space with no dust or other contaminants.

Others

The operator of the BPA00T10W500-1 should not be disturbed during operation of the broadband amplifier system. The recommended power of the BPA00T10W500-1 is 3.5kW or more. We recommend installation only in places where breakers and electric power facilities are 3.5kW or more.

3.2. Transport and Moving



Avoid product damage (damage) caused by improper transportation. Improper transport can cause the product to fall or fall, causing serious damage to the equipment.

- Broadband amplifiers must be installed with L2 Microwave or qualified personnel, although they may vary depending on the equipment.
- Do not disassemble or move the installed broadband amplifier arbitrarily.
- When moving with forklifts and other lifting machines, the broadband amplifier should not tilt to one side and move carefully to avoid affecting the internal parts. If it is tilted to one side, it may fall over, causing internal or external damage to the rack.

3.3. Power supply

The BPA00T10W500-1 wideband amplifier system operates with the following AC voltages.

- Acceptance input voltage : AC 220V single phase
- Maximum power consumption : 3.5 kW
- Power frequency : 47 Hz ~ 64 Hz

3.4. Load Condition for System Output



In general, the most defects in broadband amplifier operation are caused by high VSWR of load. Be sure to check the conditions for the amplifier load as shown below.

- Check for deficiency between amplifier output and load
- It is recommended that VSWR of RF cable applied between amplifier output and load is less than 1.22: 1.

-. Check the VSWR of the load before connecting the amplifier and load.

Check the VSWR of the antenna connected to the output of the amplifier during the radiation experiment.

The minimum required VSWR for the antenna should be used under 2.3: 1.

If the operator wants to use it under high VSWR conditions, the amplifier's output can be used at a lower level.

The following table shows VSWR condition of Load vs. Output Power of BPA00T10W500-1.

Output power	VSWR Condition of Load
500W	Under 2.3:1
250W	Under 3.0:1
100W	Under 5.84:1

4. Operation method

This chapter describes the operation and condition of the amplifier.

The AMP ON / OFF button on the front panel operates the amplifier and checks the condition of the amplifier.

If an error occurs in the amplifier, the Alarm LED on the front panel will change to RED and the amplifier will go off. To reactivate the amplifier, remove the cause of the alarm and operate by pressing the AMP ON / OFF button again.

4.1. Equipment operating sequence.


To control the amplifier, follow by below sequence for system operation.





- ① Plug in rear power switch ON.
 - Use power cable that can supply more than 3.2~3.5kW.
 - Connect to ground wire between amplifier and installation site using M5 Nut.
 - Turn on the power breaker.
- ② Check the status of the front panel of amplifier.
(Refer to “4.2 Alarm and Description for Status LED”)
- ③ Press the “AMP ON/OFF” push button. From Off mode to ON mode.
- ④ Input the RF input signal.
 - Slowly increase the input value from the -30 dBm input to the target output.

The system is off in reverse order.

4.2. Alarm and Description for Status LED

이 chapter는 전면부 상태 LED에 대한 설명입니다.

LED Status	Description	Note
	<ul style="list-style-type: none"> - State when the initial power is supplied to the amplifier. - Unchecked for each state of the amplifier. 	<p>If you turn off the power breaker on the back, it will return to the initial state.</p>

	<ul style="list-style-type: none"> - Normal operation of the amplifier through "AMP ON / OFF". - Status when there is no problem inside the amplifier - The condition that can supply RF signal to amplifier. 	<p>It is On mode and it shows that there is no problem.</p>
	<ul style="list-style-type: none"> - Indicates when there is a temperature related problem. - Excessive heat is accumulated in the module inside the system, so the system is automatically switched to the shutdown state. 	<ul style="list-style-type: none"> - After the temperature of the amplifier drops, check the status via the AMP ON / OFF button. - The static operating temperature is -20 ~ + 65 degrees inside the amplifier.
	<ul style="list-style-type: none"> - Indicates when there is a RF power related problem. - Occurs when the RF input signal to the amplifier exceeds the proper standard. 	<p>In the case of the BPA00T10W500-1, the amplifier switches off mode by an internal protection function when it is more than 2 ~ 4dB higher than the output 57dBm (= 500W). If the input returns to the normal range again, operate AMP ON / OFF again.</p>
	<ul style="list-style-type: none"> - This indicates a problem with the RF module inside the system. - If a module inside the system is damaged or there is a power problem, the corresponding LED on the front panel turns red. 	<p>The problem is illuminated if the internal module is damaged or if the applied PSU is in an abnormal state. Please contact the manufacturer if you encounter this problem.</p>