P5XXUL1
Power Amplifier User's Manual

1. General Information.

Power Amplifier (PA) is a AB/C-class unit. It is intended for amplification of single carrier phase (frequency) modulated (manipulated) narrowband signals.

The working frequency range lays between 403 MHz and 450 MHz. Code "xx" shows the input power range:

| Code: | R1 | R2 | R5 | 1 | 2 | 5 | 10 | 20 |
|---|---|---|---|---|---|---|---|---|
| Range, W: | 0.1-0.2 | 0.2-0.5 | 0.5-1.0 | 1.0-2.0 | 2.0-5.0 | 5.0-10 | 10-20 | 20-50 |

In the normal operating mode the minimum output power is 50 W.
Input VSWR is not greater than 1.8:1.
PA meets all FCC requirements to harmonic and spurious levels.

The nominal power supply voltage is 13.8VDC.
DC current consumption does not exceed 12.5A at 13.8V
Working ambient temperature range lies from -30ºC to +60ºC.

Input and output power levels are set up in the factory. Customer has an opportunity to reduce the output power, adjusting the special trimmer resistor in the unit, or picking up the value of outer resistor, connected to PA control pin.

PA has automatic power control loop that provides the stability of output power during the normal operation and all necessary changes of power in the case of load mismatch or unit overheating.

PA is intended for rack mounting in the standard 19" cabinet. The front panel is 7" high. The deepness of unit does not exceed 5".
Four LED at the front panel indicate the status of unit operation.
The hole in the side wall gives an access to the trimmer resistor, which allows reducing the output power against the set value.
There are two N connectors at the back of chassis.
There is power filtering DC connector at the back of chassis with two # 6-32 screws for "+" pole and for "-" pole.
There are 3 filters at the back of chassis that bring alarming signal, as well signals for the outside power control.
The fan at the back side of unit performs the forced air cooling. Fan starts rotating, when RF signal comes to the unit input.

2. Installation Guide.

2.1. Unit installation shall provide a proper air access to the unit; no obstacle for air is allowed closer than 3" from fan.

2.2. Copper wires # 12 AWG shall be use in DC power line. Wires shall be crimp to ring terminals.

3. Operation Guide

3.1. Power supply voltage shall be in the range 13.8 V $\pm$ 1.0 V.

3.2. The input power inside the working frequency range shall be within the listed above limits. It is prohibit applying any RF signal out of the working frequency range with a power, greater than 10% of the minimum rated one.

3.3. Green LED "DC ON" is on, when DC voltage is applied to the unit.

3.4. Red LED "LOW POWER" is on, when the output power drops below 80% - 85% of set level. In majority of cases, it warns about of inside problem. However, the output power may fail due to high load VSWR (in that case, LED tells that the power decrease is stronger, then it is needed for VSWR protection).

3.5. Red LED "HIGH VSWR" is on, when the load VSWR exceeds 2.4 – 3. The output power is reduced.

3.6. Red LED "HIGH TEMP" is on, when the heatsink temperature is over +85˚C. Then the unit operates with output power, reduced to about 75% of rated one. Fans are running continuously, no matter, is RF drive applied or not.

3.7. Voltage at filter "ALARM" is about 9.5V during the normal unit operation and drops to less than 0.5V, when any of mentioned above red LED goes on. If 1.8 kOhm resistor is connected between this filter and the ground, TTL compatible output is created.

3.8. It is possible to significantly reduce the output power, pulling filter “SH/D” to the ground (C5 units only). However, it is possible to change the output power smoothly by a trimmer resistor (50 kOhm is the recommended value of it), connected between this pin and the ground.

3.9. The output power drops to about 75% of rated level, if the filter “CTRL” is pulled to the ground (C5 units only).

- Notice: The manufacturer’s rated output power of this equipment (see Table 1-1) is specified for single carrier operation using constant-envelope modulation. This equipment is NOT designed for multiple-carrier operation, nor is it intended to be used with non-constant envelope modulation types.

**Table 1-1. Amplifier Specifications**

| Specification | Value |
|---|---|
| Instantaneous Bandwidth | 403-450MHz |
| Output Power | 50W |
| Input Impedance | 50 Ohms |
| Output Impedance | 50 Ohms |

**Table 1-2. Amplifier Input Power Ranges**

| Input Power Designator Code | Input Power Range | Nominal Gain (350W Output) |
|---|---|---|
| R1 | 0.1-0.2 W | 27.0 dB |
| R2 | 0.2-0.5 W | 24.0 dB |
| R5 | 0.5-0.5 W | 20.0 dB |
| 1 | 1-2 W | 17.0 dB |
| 2 | 2-5 W | 14.0 dB |
| 5 | 5-10 W | 10.0 dB |
| 10 | 10-20 W | 7.0 dB |
| 20 | 20-50 W | 4.0 dB |

**3.10 RF ENERGY EXPOSURE AWARENESS, CONTROL INFORMATION, and OPERATIONAL INSTRUCTIONS for COMPLIANCE with FCC RF EXPOSURE LIMITS**

**NOTICE: This power amplifier product is intended for use in environments in which personnel have full knowledge of their exposure and can exercise control over their exposure to meet FCC limits. This power amplifier is NOT authorized for use by the general population, consumer, or for use under conditions where unintended or accidental exposure may occur.**

This power amplifier product generates electromagnetic energy in the radio frequency (RF) spectrum to provide communications between users over a distance. RF energy is one specific form of electromagnetic energy. Other forms include, but are not limited to, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly, can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health, and industry work with organizations to develop standards for safe exposure to RF energy. These standards provide recommended acceptable levels for personnel who may be exposed to RF energy. The RF exposure levels described therein include substantial margins of protection.

When properly installed and used, Crescend power amplifier products meet all government-established RF exposure levels. In addition, Crescend recommends specific operating instructions for users of its power amplifier products. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it.

Please refer to the following Web sites for more information on the nature of RF energy exposure and how to control your exposure to assure compliance with established RF exposure limits.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html
http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

**Federal Communication Commission Regulations**

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for communication devices before they can be marketed in the U.S. The FCC further requires users to be fully aware of and able to control their exposure to meet RF energy exposure limits. This document includes operating instructions and information required to control your RF exposure and to satisfy compliance requirements.

**RF Exposure Compliance, Control Guidelines and Operating Instructions**

To control exposure to yourself and others and to ensure compliance with the RF exposure limits, always adhere to the following guidelines.

• Crescend power amplifier products are intended for use in fixed communication locations (e.g. base station sites). The antenna installation must comply with the following requirements to ensure optimum performance and compliance with the RF energy exposure limits required by the FCC.

1) The antenna should be mounted outside the site building on a roof, tower, or other support structure such that its location is inaccessible to personnel within the Minimum Permissible Exposure radius (see below).

2) The licensee must undertake the responsibility to manage the site in accordance with the applicable regulatory requirements. This may include, but is not limited to, providing advisory notices to all personnel who may be exposed to RF energy in the vicinity of the antenna, restricting access to areas adjacent to the antenna, or ceasing use of the power amplifier when RF energy exposure safety cannot be guaranteed.

• When the power amplifier is operating, a front panel LED will be illuminated. The power amplifier will be generating measureable RF energy exposure when transmitting.

• The maximum permissible exposure (MPE) radius is unique to each base site installation and is based on several factors such as the transmitter power output level, antenna gain, feed line loss, etc. It is the responsibility of the licensee to determine the MPE for the base site installation.

1) For 300 to 1500 MHz operation, the maximum exposure limit is determined by the expression…..

$$S = \left(\frac{f}{1500}\right) mw/cm^2$$ where f = frequency in MHz

2) An example calculation of the MPE radius for a 50 Watt UHF transmitter installation having a 5 dBi gain antenna and 1dB of feedline loss is provided below:

$Po = 50000$ mWatts

$dBd = 2.85$ antenna gain in dBd

$G1 = dBd + 2.15$ gain in dBi

$G1 = 5$ dBi

$CL = 1.0$ dB coax loss

$G = G1 - CL$

$Gn = 10^{\frac{G}{10}}$

$Gn = 2.512$ gain (numeric)

$f = 403 - 450$ MHz

$S = \frac{f}{1500} = 0.3 \ \frac{mW}{cm^2}$

See 47 CFR 1.1310

$$R = \sqrt{\frac{(Po \cdot Gn)}{4\pi \cdot S}}$$

$R = 182.5$ distance in centimeters

required for compliance

$inches = \frac{R}{2.54}$

$inches = 71.9$

$feet = \frac{inches}{12}$

3) In instances where the effective antenna gain (antenna gain – feedline loss) differs from the example above, the MPE radius must be calculated by the licensee. The table below presents the results of calculations of the MPE radius for a 50 Watt UHF transmitter having various effective antenna gain values.

| Effective Antenna Gain (dBi) | Minimum Safe Distance (meters) | Minimum Safe Distance (feet) |
|---|---|---|
| **3.0** | **1.63** | **5.34** |
| **4.0** | **1.83** | **5.99** |
| **5.0** | **2.05** | **6.72** |
| **6.0** | **2.30** | **7.54** |
| **7.0** | **2.58** | **8.46** |
| **8.0** | **2.89** | **9.49** |
| **9.0** | **3.25** | **10.65** |
| **10.0** | **3.64** | **11.95** |

- Warning

Failure to observe the minimum safe distance radius may result in exposure to RF radiated energy in excess of the FCC Maximum Permissible Exposure (MPE) limit. The licensee is responsible for the safe operation of the base site and must ensure that the Maximum Permissible Exposure limits are observed at all times.

- Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.