P25XXFF1
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.

VHF range is divided by 4 working subranges:

- 136 – 144 MHz (subrange "DA");
- 144 – 152 MHz (subrange "DB");
- 152 – 162 MHz (subrange "EA");
- 162 – 174 MHz (subrange "EB").

Subrange code is reflected in the place "FF" of PA coding: P25-XXFF1-C6-001.

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 250 W.
Input VSWR is not greater than 1.6:1.
PA meets all FCC requirements to harmonic and spurious levels.

The nominal power supply voltage is 13.8 VDC.
DC current consumption does not exceed 50 A in the normal operation 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 10" high. The deepth of unit does not exceed 5".
Four LEDs on 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 on the back of chassis.
There is power filtering DC connector at the back of chassis with four # 6-32 screws: 2 for "+" pole and 2 for "-" pole.
There are 3 filter feedthroughs on the back of chassis that bring out the alarm signal, as well signals for the outside power control.
Two fans on the back side of unit perform the forced air cooling.

2. Installation Guide

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

2.2. Copper wires # 10 AWG shall be use in DC power line. Wires shall be crimped to ring terminals. Two parallel wires shall be use for the positive voltage and two parallel wires shall be used for the ground side.

Put terminal under PI-shape shunts on DC connector. Do not remove shunts!

3. Operation Guide

3.1. Power supply voltage shall be in the range 13.8 V $\pm$ 0.8 V.

3.2. The input power within the working frequency range shall be within the listed above limits. It is prohibited to apply 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 the majority of cases, it warns about an internal problem. However, the output power may fail due to high load VSWR (in this case, the LOW POWER LED tells that the power decrease is stronger than is needed for VSWR protection).

3.5. Red LED “HIGH VSWR” is on when the load VSWR exceeds 2.4 – 3.0. 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 an output power reduced to about 75% of rated.

3.7. Voltage at filter “ALARM” is approximately 9.5V during normal operation and drops to less than 0.5V when any of above mentioned red LEDs turns on. If a 1.8 kOhm resistor is connected between this filter and the ground, a TTL compatible output is created.

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

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

3.10. In fan operation test, fans are running during the first 3 seconds after the moment that DC voltage is applied to the unit. Fans start rotating when an RF signal is applied at the input, with delay of 3 sec and stops rotating 8 sec after switching RF off. In the case of unit overheating fans are running continuously, no matter, is RF signal applied or not.

- **Notice: The manufacturer’s rated output power of this equipment (see Table 3-1) 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 3-1. Amplifier Specifications

Specification	Value
Instantaneous Bandwidth	136-174 MHz
Output Power	250 W
Input Impedance	50 Ohms
Output Impedance	50 Ohms

Table 3-2. Amplifier Input Power Ranges

Input Power Designator Code	Input Power Range	Nominal Gain (250W Output)
R1	0.1-0.2 W	34.0 dB
R2	0.2-0.5 W	31.0 dB
R5	0.5-1 W	27.0 dB
1	1-2 W	24.0 dB
2	2-5 W	21.0 dB
5	5-10 W	17.0 dB
10	10-20 W	14.0 dB
20	20-50 W	11.0 dB

4.0 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…..

$$S = \left(\frac{f}{1500}\right) \text{mw} / \text{cm}^2$$ 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

f = 403 - 450 MHz

dBd = 2.85 antenna gain in dBd

G1 = dBd + 2.15 gain in dBi

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

G1 = 5 dBi

See 47 CFR 1.1310

CL = 1.0 dB coax loss

G = G1 - CL

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

Gn = 2.512 gain (numeric)

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

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	**4.45**	**14.6**
4.0	**5.00**	**16.4**
5.0	**5.61**	**18.4**
6.0	**6.29**	**20.6**
7.0	**7.06**	**23.2**
8.0	**7.92**	**26.0**
9.0	**8.89**	**29.2**
10.0	**9.97**	**32.7**

- 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.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée quivalente (p.i.r.e.) ne dépassepas l'intensité nécessaire à l'établissement d'une communication satisfaisante.