Pacific Microwave Research, Inc.

AT-100 Series

Microwave Video and Audio Transmitter

USER'S MANUAL

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S/N _____

IMPORTANT WARNING!
THIS EQUIPMENT WILL POSE A RADIATION HAZARD IF IMPROPERLY HANDLED

Pacific Microwave Research, Inc. (PMR), in compliance with RF exposures limits set forth in OET Bulletin 65, Fourth Edition, August, 1999.[1] The following text is intended to notify the user of PMR's transmitter equipment that a radiation hazard could exist if the AT-100C3 transmitter is improperly operated. The user should carefully read and understand this section before operating equipment.

PMR's AT-100C3 microwave transmitter is rated at 0.5W (+27 dBm) nominal RF power output and has been designed as an intentional radiator. The transmitter may produce as much as 1.0W (+30 dBm). The device can deliver video and audio signals over short ranges when used with PMR's AR-100C3 receiver and appropriate antennas in either fixed or mobile applications. When the AT-100C3 transmitter is operating into an antenna, the system is emitting radio frequency energy!

An internal RF isolator prevents emission of energy at the antenna terminal when no antenna is connected even when the transmitter is powered up. Because the AT-100C3 is an isolator protected low power device, there is no hazard potential until a proper antenna is connected to the RF output terminal. Safe operating procedures must be observed when the unit is transmitting into an antenna.

Exposure is based upon the average amount of time spent within an electromagnetic field (RF energy) with a given intensity (field intensity in mW/ cm^2). There are two categories of exposure situations; occupational/controlled and general population/uncontrolled.

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. These limits apply in situations when an individual is transient through a location where occupational/controlled limits apply provided the individual is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

[1] The complete text may be found at:
www.fcc.gov/bureaus/engineering_technology/documents/bulletins/oet65/oet65.pdf

Exposure may be controlled by observing the safe distances found in Table 1 or calculating the safe distance for any particular installation based on the formula found in the section containing sample calculations. The user should insure that the minimum distance from the antenna is maintained at all times when the transmitter is operating.

The safe distance is based on the MPE exposure limits identified in Table 1. (FCC Limits for Maximum Permissible Exposure) of OST 65. The maximum power density allowed at 6400 MHz is 5 mW/cm^2 for occupational/controlled exposure, and 1 mW/cm^2 for general population/uncontrolled exposure.

For mobile operations, based upon a maximum transmitter power output of 1.0W and an antenna gain of +2 dBi, the safe distance is less than 20 cm from the antenna for both controlled and uncontrolled exposure.

Exposure level is relative to antenna gain. Gain antennas (parabolic dish, horn, helical, Yagi, etc.) will increase the safe distance required. A typical high-gain antenna used for fixed applications may exhibit up to 30 dBi gain. The high-gain antenna concentrates transmitter energy into a narrow beam and extends the safe operating distance. Table 1 indicates the safe distance for fixed operations, within the main beam of the antenna, based upon a maximum transmitter power output of 1.0W and an antenna gain of +30 dBi.

Frequency – 6400 MHz	**TX Power – 1.0W (+30 dBm)**	**Antenna Gain - +30 dBi**
Safe Distance from Antenna Under Fixed Conditions		
Controlled Exposure (5 mW/cm^2)	**Uncontrolled Exposure (1 mW/cm^2)**	
1.3 m	**2.8 m**	

Table 1. FCC limits for MPE based on OST 65 for PMR AT-100C3 Transmitter (fixed)

If the AT-100C3 is operated at a fixed location and other transmitters are co-located, the user must consider exposure as a result of the aggregate collection of transmitters at the location. Increases of four times in radiated energy level will double the safe distance.

The user must calculate the safe distance for any given case based on the antenna gain required for the application. Pacific Microwave Research can provide such calculations in consultation with the user if required. Contact PMR at 760.295.5416 for additional information.

SAMPLE CALCULATIONS

Equation:

$$r = \sqrt{\frac{EIRPmW}{4\pi \bullet Pd}}$$

Where:
r= safe distance in cm
EIRPmW = TX power(dBm) plus Antenna gain (dBi) in mW {referenced to isotropic radiator}
Pd= Power density in cm^2 (1 or 5)

Example: Fixed use with 30dBi antenna under uncontrolled conditions.

$$r = \sqrt{\frac{1{,}000{,}000}{4\pi \bullet 1}}$$

Where:
r= 282 cm (2.82 m)
EIRPmW = +60 dBm (30 + 30) = 1,000,000 mW
Pd= Power density $5cm^2$

Example: Fixed use with 30dBi antenna under controlled conditions.

$$r = \sqrt{\frac{1{,}000{,}000}{4\pi \bullet 5}}$$

Where:
r= 126 cm (1.26 m)
EIRPmW = +60 dBm (30 + 30) = 1,000,000 mW
Pd= Power density $5cm^2$

1.0 Introduction

The AT-100C3 Microwave Video and Audio Transmitter from Pacific Microwave Research is a compact transmitter designed for short-range transmission applications under FCC Part 74, and Part 101. Common uses include law enforcement surveillance and electronic field production. The AT-100C3 is a compact unit designed for portable and field applications to transmit remote video to a central receive location. The AT-100C3 is designed to transmit one NTSC (or PAL) video signal plus two high quality video signals. The AT-100C3 operates from a 12 Vdc power source and is capable of up to 1.0 Watts of output power (0.5 W nominal). The AT-100C3 may be equipped with up to 16 channels consistent with parameters listed on the user's FCC station license.

2.0 Operation

The following section describes the proper operating techniques for the AT-100C3 transmitter including power, antenna, video, and audio connections. The AT-100C3 generates heat during normal operation. The user should give careful consideration to mounting the transmitter in such as way as to insure heat is directed away from the housing. An external heatsink may be desirable in some operational modes.

2.1 Primary Connections

A number of connections must be made in order for the AT-100C3 to operate properly. These include dc power; transmit antenna, video input, and audio input.

WARNING

Prior to transmitting, the user should determine the proper frequency or channel of operation. Operating on the wrong frequency could cause interference to other licensed users. Part 101 users may coordinate frequencies through nationally recognized frequency coordination bodies or through local law enforcement user groups. Part 74 users should contact their local frequency coordinator or check www.sbe.org for additional information. Always verify a frequency is not in use before transmitting.

2.1.1 DC Power Input

The AT-100C3 is designed to operate from a nominal +12 Vdc power source. Power is supplied through the front panel DB-9M connector (J3) with +12 Vdc on Pin 5 and

Ground on Pin 9. This source should be fused at 2.0 A. The AT-100C3 will operate over a voltage range of +11 to +14.5 Vdc. Power consumption at the high power setting (0.5 W) is nominally 1.2 A. Power consumption at the low power setting (0.1 W) is nominally 0.7 A. The input to the AT-100C3 is internally protected against reverse polarity. The AT-100C3 transmitter is operating whenever power is applied.

2.1.2 Antenna

The antenna is connected to front panel female SMA connector (J9). Any resonant antenna is suitable for connection. Antenna type and gain should be determined based upon the intended application. Only high quality coaxial cable should be used to interconnect the transmitter and antenna. All SMA connectors should be tightened with the appropriate 5/16" wrench using approximately 5 in./lbs of torque. MAXIMUM TORQUE IS 8 IN./LBS. DO NOT OVERTIGHTEN. Thumb tight connections are not suitable for reliable operation!

2.1.3 Video Input

Video is input to the AT-100C3 through the front panel BNC connector (J10). This unbalanced input accepts a nominal 1 Vp/p video input. The transmitter may be factory configured for the NTSC or PAL standard. An NTSC transmitter must be used with an NTSC receiver. A PAL transmitter must be used with a PAL receiver. Maintenance of proper video levels is important to prevent over-modulation of the transmitter. High video levels could potentially cause interference to adjacent channel users. Low video levels will result in a lack of luminance at the receiver. Proper link performance demands attention to video levels.

2.1.4 Audio Input

Audio is input to the AT-100C3 through the front panel DB-9M connector (J3). Typically, the AT-100 is configured for two audio subcarrier channels. Each audio subcarrier has a balanced input with a nominal impedance of 600 Ω. The AT-100C3 may be factory configured for line or microphone level inputs. Line level audio is typically 0 dBm and microphone level is typically –50 dBm. Full deviation (± 75 kHz) on a transmitter configured for line level input is represented by a signal input level of + 9 dBm at 400 Hz. The input for subcarrier number one is on Pin 2 (+) and Pin 7 (-). The input for subcarrier number two is on Pin 3 (+) and Pin 8 (-). Unbalanced audio may be connected to the subcarrier inputs by connecting the high side of the audio source to the (+) terminals and leaving the (-) terminals unconnected.

3.0 Power Output

The AT-100C3 is capable of operating at two power levels to fit a variety of operational scenarios. The high power setting is defaulted with no connection to Pin 1 of J3. The nominal power output on high power is 0.5 W. To select low power, Pin 1 of J3 must be connected to ground. This can be accomplished by placing a jumper in the rear of the mating connector (Pin 6), by a remote switch, or by an open collector transistor junction.

4.0 Frequency Selection

Frequency selection of the AT-100C3 is accomplished by operation of a 16-position rotary switch located on the rear panel. Use a small flat blade screwdriver or "tweaker" tool to operate the switch. Frequencies are programmed into the transmitter in accordance with the users FCC license parameters. Your radio **(S/N _____)** is programmed as indicated in Table 1.

CH	FREQ MHz
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Table 1. AT-100 Channel Assignments

PIN	MHz
1	1
2	2
3	4
4	8
5	10
6	20
7	40
8	80
9	100
10	200
11	400
12	N/C
13	N/C
14	N/C
15	N/C

Table 2. Remote Frequency Control

As an option, users may select the frequency of operation of the AT-100C3 in 1 MHz steps. This is accomplished by connecting a BCD switch to optional connector J11 in accordance with the pin-out shown in Table 2. This option is only available to government users.

5.0 Specifications

Electrical:

- Frequency Range
  - AT 100C3 – 6.4 to 7.1 GHz
- VSWR – Infinite (open or short)
- Modulation – True FM
- Modulation Sense – Positive
- Frequency Stability – ±0.002%
- Emphasis – NTSC or PAL
- Spurious/Harmonic Output – > -65 dBc
- Analog or Digital Input filtering options
- Video Input Impedance – 75 Ω unbalanced
- Video Input Response – 10 Hz to 4.5 MHz
- Video Input Sensitivity – 8 MHz/Volt
- Audio – any two between 5.5 to 7.5 MHz
  - Phase Lock Loop
  - 20 Hz to 20 kHz ±1.5 dB
    - 600 Ω Balanced Input
    - Microphone or Line Level
- Power Output
  - High Power – 0.5 W nominal
  - Low Power – 0.1 W nominal

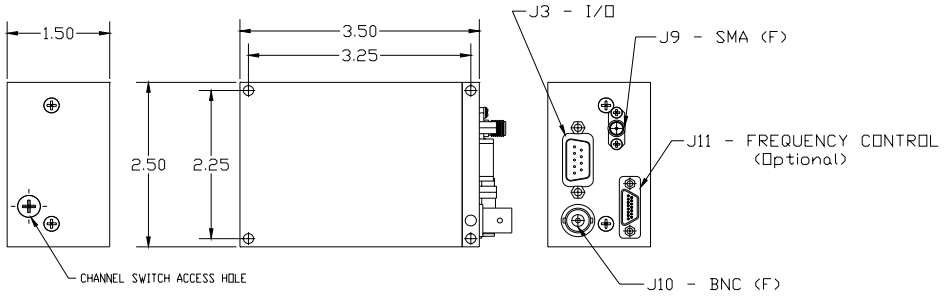
Environmental:

- Operating temperature: -10 to +65 °C
- Relative Humidity: 0 to 95%, non-condensing

Mechanical:

- 9-pin full function I/O connector
- Dimensions – 1.5 H x 2.5 W x 3.5 L inches
- Video Input – BNC female
- Housing – milled aluminum
- Weight – 6.0 oz.
- RF Output – SMA female

6.0 Mechanical



7.0 Connector Pin-out

Connector J3 ■ DB-9 Male ■ System I/O
Connector Pinout Data

Pin #	Function
1	Lo/Hi Power – Tie to ground for low power
2	Audio 1 Input (HI)
3	Audio 2 Input (HI)
4	Aux Video Input (parallel with J10 BNC)
5	+11 to +14.5 Vdc – Primary power input
6	Ground
7	Audio 1 Input (LO)
8	Audio 2 Input (LO)
9	Ground

8.0 Repair

There are no user serviceable parts inside the AT-100C3. Damage to the QC seals on the transmitter voids the warranty. Should your unit require service, contact Pacific Microwave Research, Inc. at 760.295.5416 or www.pmicrowave.com to request an RMA number.