

Xeta7m-T

User Manual



XETAUJAVE

C U S T O M R F S O L U T I O N S

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Warranty

XetaWave LLC warrants your XetaWave wireless data transceiver against defects in materials and manufacturing for a period of two years from the date of purchase. In the event of a product failure due to materials or workmanship, XetaWave will, at its discretion, repair or replace the product.

In no event will XetaWave LLC, its suppliers or its licensors, be liable for any damages arising from the use of or the inability to use this product. This includes business interruption, loss of business information, or other loss which may arise from the use of this product. XetaWave LLC transceivers should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. XetaWave LLC accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the XetaWave transceiver, or for the failure of such transceiver to transmit or receive such data.

Warranty policy may not apply:

- 1) If product repair, adjustments, or parts replacements is required due to accident, neglect or unusual physical, electrical or electromagnetic stress.
- 2) If product is used outside of XetaWave specifications.
- 3) If product has been modified, repaired or altered by Customer unless XetaWave specifically authorized such alterations in each instance in writing.

The warranty period begins from the date of shipment and is defined per the standard warranty policy stated above.

Information in this document is subject to change without notice. The information contained in this document is proprietary and confidential to XetaWave LLC. This manual is for use by purchasers and other authorized users of the XetaWave wireless data transceiver only.

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This product is licensed by the United States. Diversion contrary to U.S. law is prohibited. Shipment or re-export of this product outside of the United States may require authorization by the U.S. Bureau of Export Administration. Please contact XetaWave LLC for assistance and further information.

FCC Notifications

Federal Communications Commission

This device complies with Title 47 CFR § Part 27 of the federal code. Specifically, 47CFR § 1.1310, Table 1, Limits for General Population/Uncontrolled Exposure.

This device must be operated as supplied by XetaWave LLC. Any changes or modifications made to the device without the express written approval of XetaWave LLC may void the user's authority to operate the device, pose violations and liabilities.

Caution

The model number Xeta7M-T has a maximum transmitted output power of 35 dBm when used in the 757-758MHz and 787-788MHz bands. The transmit antenna shall be kept at least 82 cm from physical space where humans may exist.

Additional details may be found in the "RF Exposure Calculations" at the end of this section.

These limits are designed to provide reasonable protection against harmful 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, 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:

- 1) Reorient or relocate the devices and/or antennas.
- 2) Increase the separation between the equipment and the receiver.
- 3) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- 4) Consult the dealer or an experienced RF/radio/Electronics professional for help.

NOTE TO OEMS:

For host manufacturer's when using a certified module, the following must be adhered to:

1. If (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent external label referring to the enclosed module: "Contains Transmitter Module FCC ID: PEJ-XKJS7" or "Contains FCC ID: PEJ-XKJS7" must be used.
2. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.



WARNING

These radio systems shall be installed by a RF/radio professional familiar with the applicable rules. Installation of all antennas shall be performed in a manner that will provide at least the MPE Distance from the direction of maximum radiation, to any user or member of the public and consistent with the settings in the applicable antenna installation compliance section below.

FCC antenna compliance

Since professional installation is required, standard RF connectors are used. Adapters or custom coaxial cables may be required to connect the radio output connector to the desired antenna.

Any antenna from a reputable manufacturer with desired bandwidth, gain/pattern coverage, and have an input surge impedance of approximately 50 ohms can be used.

Maximum antenna gain of 11dBi in both the 757-758MHz and the 787-788 MHz bands.

Exposure Compliance

FCC ID: PEJ-XKJS7

It is the responsibility of the licensee or user to guarantee compliance with the appropriate MPE regulations when operating this device in a way other than described herein. The installer of this equipment must ensure the antenna is located or oriented such that it does not emit an RF field in excess guidelines as posted in the 47 CFR Bulletin 65/47CFR § 1.1310 of the Federal Communications Commission, or the Council of European Union as appropriate.

The XetaWave XETA7 uses a low power radio frequency transmitter. The concentrated energy from an antenna may also pose a health hazard in the near field. People should not be near the antenna when the radio link is operating as general practice and maintain a safe distance as calculated below.

The following calculations are based off the Maximum Permissible Exposure requirements as outlined by the FCC.

The MPED (Maximum Permissible Exposure Distance) is calculated based on the limits for a General Population/Uncontrolled Exposure in the 300-1500 MHz frequency band using the stated MPE power density limit of F/1500 mW/cm² for General population /Uncontrolled environment. To calculate safe distance:

$$\text{Equation 2: } MPED = \sqrt{\frac{(ConductedPower(mW))(DutyCycle)(AntennaGain)}{(4\pi)(ExposureLimit(mW / cm^2))}}$$

Where: MPED is Maximum Permissible Exposure Distance or safe distance in cm

All quantities are calculated in linear or numeric quantities.

Duty cycle is set using packet sizes for master and slave. Packet sizes are set in the radio Network Configuration Menu. At Power up and with no data transmitting, the radios

will transmit or beacon with a duty cycle of 6 to 10% depending upon modulation setting.

The worst case exposure limit MPED for 757MHz is shown in the table below.

| Table of MPE Safe Distance vs. Antenna Gain and Power Output Setting | | | | | |
|---|----------------------------|---------------------------|------------------------------|--|---------------------------|
| Power Out Setting (mW)* | Duty Cycle (linear) | Antenna Gain (dBi) | Antenna Gain (linear) | FCC MPE Limit (mW/cm²) | Safe Distance (cm) |
| 3388.4338 | 1.0 | 11.0 | 12.7 | F/1500 | 82 |

Installation and configuration

Xeta7 Installation

The XETA7 is a board level radio that is intended to be integrated into a customer package. As such the antenna placement must be done in a manner that is in compliance with all local regulations.

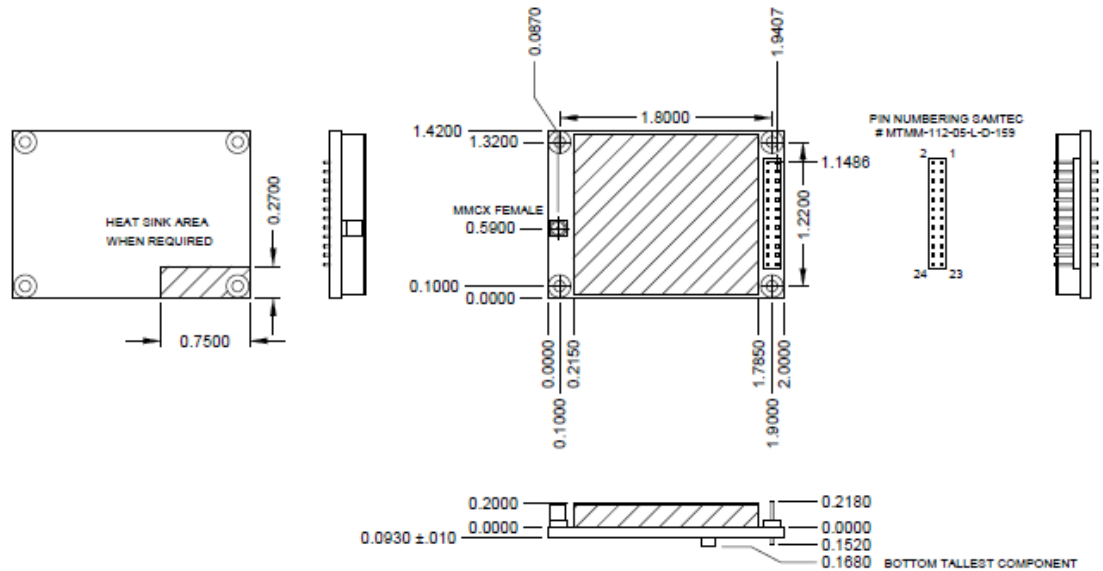
All transceivers sold under the FCC ID PEJ-XKJS7 must be installed professionally. This transceiver is only approved for use when installed in devices produced by Xetawave LLC or third party OEMs approved by Xetawave LLC.

Antenna Installation

Any antenna from a reputable manufacturer with desired bandwidth, gain/pattern coverage, and have an input surge impedance of approximately 50 ohms can be used with the Xeta7. Since professional installation is required, standard RF connectors are used. Adapters or custom coaxial cables may be required to connect the radio output connector to the desired antenna, provided the appropriate requirements are met.

Mechanical Interface:

The XETA7 has four mounting holes located 0.100 inches from the outside edge of the board as seen below:



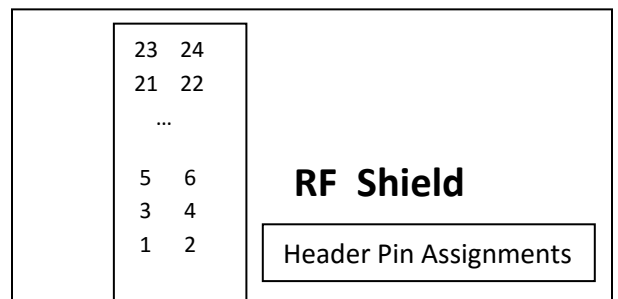
The four mounting holes have a 0.093" diameter finished opening 0.100" from the edges designed for a #2-56 screw. The clearance height of the radio is 0.210" shield height, .103" PCB height, 0.070" back side height. (The connectors are on the side with the shield.)

Heat Sink contact is on the opposite side of the connectors/shield at the lower left corner (back side as shown above).

Electrical power/signal interface:

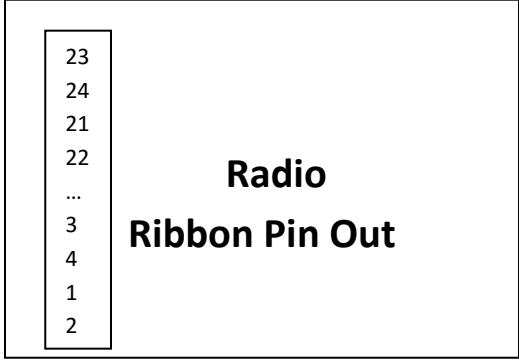
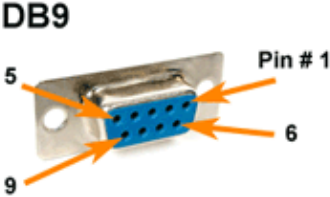
Header assignment: 24-pin 2-row Samtec part MTMM-112-05-L-D-159

| | | | |
|----------|-----|-----|---------------|
| GPIO | :23 | 24: | GPIO |
| GPIO | :21 | 22: | GPIO |
| Sig GND | :19 | 20: | Baud Clk |
| Diag RX | :17 | 18: | Diag TX |
| Data RTS | :15 | 16: | Data CTS |
| Data RX | :13 | 14: | Data DCD |
| Data TX | :11 | 12: | RSSI (option) |
| Data DTR | :9 | 10: | Power GND |
| Power IN | :7 | 8: | DNC |
| DNC | :5 | 6: | GPIO_HS |
| DNC | :3 | 4: | DNC |
| DNC | :1 | 2: | DNC |

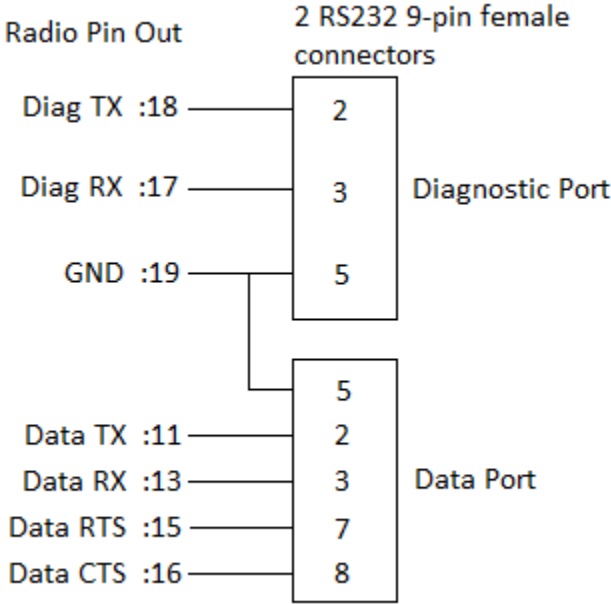


Note: rows are reversed compared to standard nomenclature.

This means that when a 24 pin connector is used to attach a ribbon cable, the pins will be staggered in a non-conventional way.



The radio pin out may be connected to two DB9 connectors according to the following pin diagram:



Depending upon configuration, before connecting to a computer, each serial port may need to pass through a 3.3V TTL to RS232 converter such as this SerialComm TTL-232-33P. The radio is either manufactured for a high speed 3.3V interface or for a conventional speed RS-232 interface.



In order to power the radio, 7.5V +/- 10% DC must be applied across pins 7 and 10.

Communicating with the XETA7 using a serial interface terminal

| | |
|-------------------------|--------|
| Bits per Second (Baud): | 115200 |
| Data Bits: | 8 |
| Parity: | None |
| Stop Bits: | 1 |
| Flow Control: | None |

The computer's serial port must be configured by the user to match this configuration to communicate. Once the radio is connected to the computer, power may be applied to the radio resulting in the following initialization or boot sequence information being displayed on the terminal:

```
spi_init(SPI_BUS_0)
spi_init(SPI_BUS_1)
twi_init()
iox_init()
pll_init(TRUE)
interrupt_init()
timer_init()
mon_init()

Xetawave Bootloader revision 1.17.1410 for rev 5 board

Booting . . .

spi_init(SPI_BUS_0)
spi_init(SPI_BUS_1)
```

```
twi_init()
iox_init()
pll_init(TRUE)
interrupt_init()
timer_init()
if_init()
synth_init()
params_load()
sport_init(SPORT_BUS_0)
sport_init(SPORT_BUS_1)
daca_init()
dac_init()
recv_init()
xmit_init()
crc_init()
math_rand_set_seed(params.serial_number)
ecc_init()
pwm_init()
watchdog_init()
mon_init()
Serial Ports: Data=921600:8N1; Diag=115200:8N1;
Starting . . .
```

Configuring the XETA7 module

The minimal steps to configure a radio are:

- 1) Verify and/or configure the serial port speeds (both diagnostics and data ports)
- 2) Configure the radio for network operation:
 - a. Master, Repeater, or Slave (one master per network)
 - b. Network operation of “point-to-point” or “point-to-multipoint”
 - c. Network address that is shared by all radios on the network
 - d. Radio address of this radio (“1” if master)
 - e. Address of radio upstream (closer to the Master)
 - f. Address of radio downstream (farther from the Master)
 - g. Set the data block size sent downstream and upstream
- 3) Set the RF data rate speed and modulation method
- 4) Set the transmit power
- 5) Set the distance between the radios for worst case propagation delay.

Once communication with the Xeta7 has been established using the serial communications interface, the standard menu based prompt will be displayed. Using this interface, the radio can be controlled and the following parameters can be configured:

Operation Reference Map

0: Main Configuration Menu

0: Serial Menu

- 0: Set Data Serial Bit Rate
- 1: Set Data Serial Framing
- 2: Set Data Serial Protocol
- 3: Set Baud Clock Multiplier
- 4: Set Data Serial flow control
- 5: Set Serial message delay
- 6: Set Data Serial interface (RS232, 422, 485)
- 7: Set RS485 after delay
- 8: Set RS485 before delay
- 9: Set seamless group

1: RF and Hopping Menu

- 0: RF Band (Fixed)
- 1: Set Maximum separation
- 2: Set RF Transmit Power
- 3: Set RF Master Transmit Frequency
- 4: Set RF Slave Transmit Frequency

2: Bit Rate and Modulation type Menu

- 0: Toggle between data rates and modulation methods

3: Network Menu

- 0: Set Operating Mode (Master; Slave; Repeater)
- 1: Set Network Type (M to S; M to R to S; M to xS)
- 2: Set Network Address (unique 9-digit value)
- 3: Set Upstream Device Address
- 4: Set Downstream Device Address
- 5: Set Maximum Payload Size, Master
- 6: Set Maximum Payload Size, Slave
- 7: Set Device Address
- 8: Set Radio name

4: Advanced Menu

- 0: Set Multi-master sync mode
- 1: Set Idle beacon period
- 2: Toggle Dynamic payload mode

5: Utilities Menu

- 0: Scan RF Band
- 1: Download Firmware Update
- 2: Scan Network (for information on other radios in the network)
- 3: Ping a radio on the network
- 4: Run throughout test
- 5: Show throughput statistics
- r: restore factory defaults

LED Display

The radio board has 4 LEDs mounted near the edge that indicate: power applied, transmit in progress, receive in progress, and a spare for special use.