XETA24M-T

User Manual (Preliminary)

February 25th 2015

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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.

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 & IC Notifications

Federal Communications Commission & Industry Canada

This device complies with Title 47 CFR § Parts 1, 15, 101 of the federal code along with Industry Canada: RSS-102, Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands) and Safety Code 6 of Health Canada.

Specifically, 47CFR § 1.1310, Table 1, Limits for General Population/Uncontrolled Exposure and RSS-102, Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands) Table 4.2 RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment).

Operation is subject to the following two conditions:

1) This device may not cause harmful interference and
2) this device must accept any interference received, including interference that may cause undesired operation.

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

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le present appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, méme si Ie brouillage est susceptible d'en compromettre Ie fonctionnement

Caution

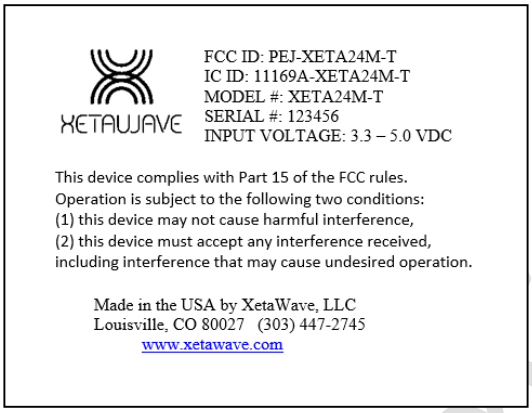
The model number XETA24 has a maximum transmitted output power of 1000 mW when used in the 2402-2483MHz band. The transmit antenna shall be kept at least 71.11 cm from psychical space where humans may exist. Additional details may be found in the "RF Exposure Calculations" at the end of this section.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Title 47 CFR § Part 15 and ICES-003. 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: Whenever any XetaWave LLC module is placed inside an enclosure, a label must be placed on the outside of that enclosure which includes the module's FCC ID and IC 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.

Exposure Compliance

FCC ID: PEJ-XETA24M-T

IC ID: 11169A-XETA24M-T

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 Canadian RSS-102/Safety Code 6 of Health Canada, 47 CFR Bulletin 65/47CFR § 1.1310 of the Federal Communications Commission, or the Council of European Union as appropriate.

The XetaWave XETA24 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.

Note: Industry Canada and the FCC use the same RF power density level for their limits, but express them in different units. The US/FCC/OSHA/ANSI use milliwatts per square centimeter (mW/cm2) and Industry Canada uses Watts per square meter (W/m2).

Equation 1: $$W/m^2 = 10(mW/cm^2)$$

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

The MPED (Maximum Permissible Exposure Distance) is calculated based on the limits for a General Population/Uncontrolled Exposure in the 1,500 – 100,000 MHz frequency band using the stated MPE power density limit of 1.0 mW/cm^2 or 10 W/m^2. The following table provides safe distance for several power levels and antennas besides the worst case for convenience.

To calculate safe distance:

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

Where:

MPED is Maximum Permissible Exposure Distance or safe distance.

All quantities are calculated in linear or numeric quantities.

The exposure limit, MPED, and conducted power units must be consistent, mW and cm for this case.

Duty cycle is set using packet sizes for master and slave. The highest duty cycle, 93%, that can be set is 1600 transmit and 64 receive using a modulation of 57 kbps MSK. Packet settings are set in the radio Network Configuration Menu. If the radio is a master then master packet size is set to 1600 and slave packet size is set to 64. All radios in the link must have the same master and slave settings. 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 limits for Industry Canada are in Watts per square meter and easily calculated from equations 2 and then 1 above.

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/cm^2)**	**IC MPE Limit (W/m^2)**	**Safe Distance (cm)**
1000	0.93	20	100	1.0	10	86.03
1000	0.93	15	31.62	1.0	10	48.37
1000	0.93	12	15.85	1.0	10	34.25
1000	0.93	3	2.00	1.0	10	12.17
100	0.93	20	100	1.0	10	27.20
100	0.93	15	31.62	1.0	10	15.3
100	0.93	12	15.85	1.0	10	10.83
100	0.93	3	2.00	1.0	10	3.85
10	0.93	20	100	1.0	10	8.60
10	0.93	15	31.62	1.0	10	4.83
10	0.93	12	15.85	1.0	10	3.42
10	0.93	3	2.00	1.0	10	1.22
*The worst case is 1000 mW with an antenna with 20 dBi gain or greater or 86.03 cm as power output is reduced as required by the appropriate regulating authority.						

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 provided the requirements of Title 47 CFR Part 51.247 (a), (b) and (c) are met, i.e. conducted power of 1W (30 dBm) or EIRP of 4W (36 dBm) maximum in a PTMP configuration. If the antenna gain is greater than 6 dBi, the power setting shall be reduced by the amount the gain of the antenna exceeds 6 dBi. In other words the EIRP cannot exceed 4W or 36 dBm for a PTMP Configuration. In a fixed PTP link configuration you can increase the antenna gain to get an EIRP above 36 dBm but for every 3dBi

increase of antenna gain you must reduce the transmit power by 1 dBm. The table below shows the combinations of allowed transmit power / antenna gain and the resulting EIRP.

Transmit Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
30	6	36
29	9	38
28	12	40
27	15	42
26	18	44
25	21	46
24	24	48
23	27	50
22	30	52

Industry Canada antenna compliance

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 isotropic radiated power (E.I.R.P.) is not more than that necessary for successful communication.

Conformément a la réglementation d'lndustrie Canada, cet émetteur radio ne peut fonctionner a l'aide d'une antenne d'un type et maximum (ou moins) Gain approuvé pour l'émetteur par Industrie Canada. Pour réduire Ie risque d'interférence avec d'autres utilisateurs, le type d'antenne et son gain doivent étre choisis afin que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas ce qui est nécessaire pour une communication réussie.

This radio transmitter 11169A-XETA24M-T has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet émetteur radio 11169A-XETA24M-T a été approuvé par lndustrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous avec Ie gain maximal admissible et l'impédance d'antenne requise pour chaque type d'antenne indiqué. Types d'antennes ne figurent pas dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdites pour une utilisation avec cet appareil."

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Heath Canada's website *www.hc-sc.gc.ca/rpb*.

The following antennas are approved for US & Canadian use as detailed below.

	Gain				Impedance
Type	**dBi**	**Antenna**	**Manuf.**	**Part Number**	**Input (Ω)**
Small, radio connected, omni-directional	3	Rubber Duck	Laird	MAF94300	50
Base station directional	11	Yagi	L-Com	HG824-11LP-NF	50
Base station, omni-directional	12	Tubular vertical	TPLink	TL-ANT2412D	50
Base station, Panel	19	Panel	ITElite	SRA0.9/2.4/5	50

1 Specifications (Preliminary and TBC)

1.1 Performance

Transmitter	
Frequency Range	2.402-2.483 GHz: ISM-FHSS, DTS
Output Power	10mW to 1W, step size 1dB
Range – Line of Sight	30+ miles
Modulation	MSK, BPSK, QPSK, 8-PSK, 16-PSK, 16 QAM, 32 QAM
RF Data Rate	115 kbps to 4.4 Mbps
Occupied Bandwidth	100 kHz to 1.5 MHz
Frequency Stability	1.0 ppm
Duty Cycle	Continuous
Output Impedance	50 Ohms
Receiver	
Sensitivity - ISM (dBm) *Estimated - final values tbc*	- 110 @ 115 kbps - 97 @ 1.77 Mbps -108 @ 153 kbps -92 @ 2.65 Mbps -100 @ 883 kbps -88 @ 3.53 Mbps
Data Transmission	
Error Detection	Up to 32-bit CRC, Retransmit on error
Data Encryption	AES 256
Data Interfaces	TTL
Data Connector	24-pin connector
Serial Interface Speed	2 Mbps TTL
Power / Physical	
Operating Voltage	3.3-5.0 +/-10% VDC | 2.5V MIN with reduced performance
Transmit Current	< 1.0 A @ 5V for 1W RF
Receive | Idle | Sleep Current | Low Power @ 5V, radio only	<275mA | <150mA | <3.0mA | 5uA
RF Connector	MMCX
Dimensions (L x W x H)	2.0" x 1.4" x 0.37"
Weight	24 grams

Specifications subject to change without notice. *11.2014*

1.2 Environmental

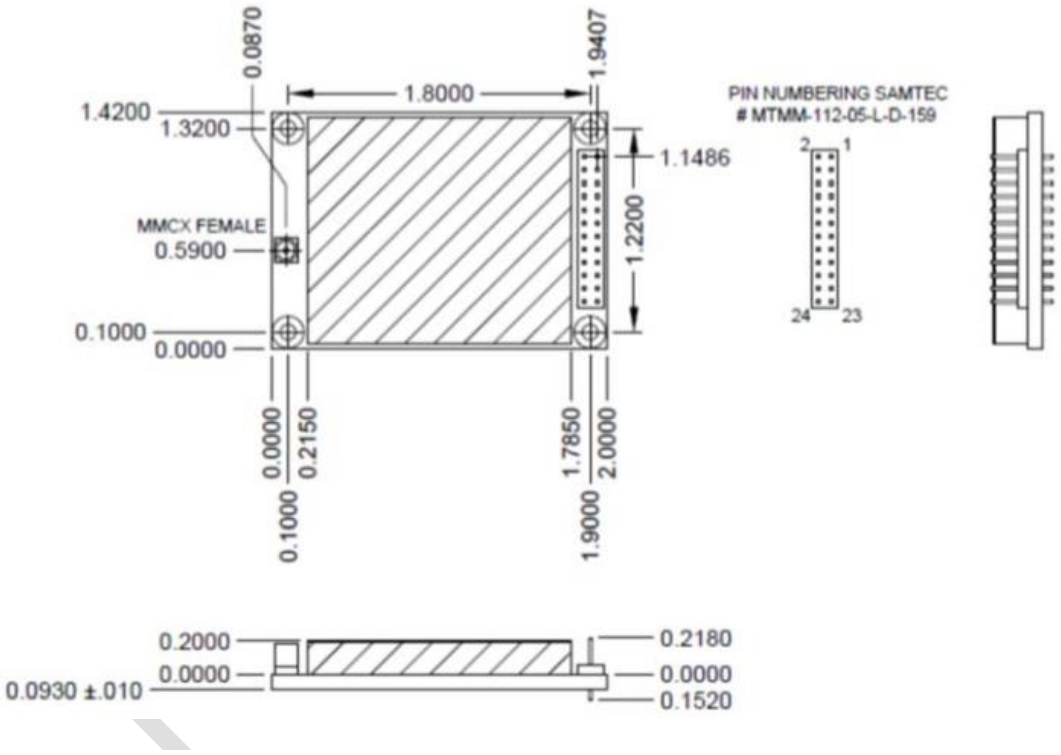
- -40°C to +85°C operating temperature range. -55°C available. Exceeds MIL-STD-810G methods 501.4 and 502.4.
- 95% operating humidity @ 40°C non-condensing.
- Exceeds MIL-STD-810G methods 501.4 and 502.4.
- Humidity storage satisfies MIL-STD-810G method 504.7
- Shock & vibration satisfies MIL-STD-810G methods 514.5 and 516.5 3-axis 3G vibration and 40G shock.

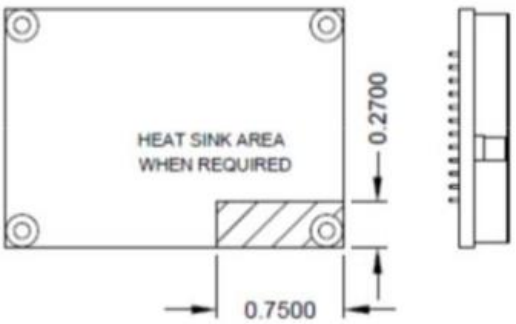
1.3 Security & Certifications

- AES 256-bit encryption
- Password authentication
- FIPS 140-2 validation in progress
- FCC, UL Class 1 Div 2 and ETSI

1.4 Mechanical / Physical Design

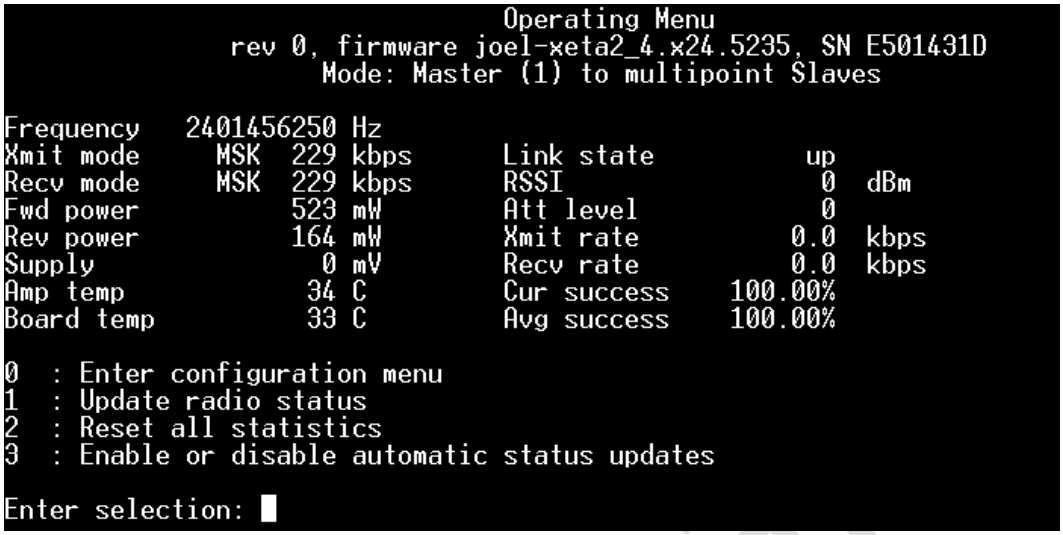
OEM Module: 2.0" x 1.4"



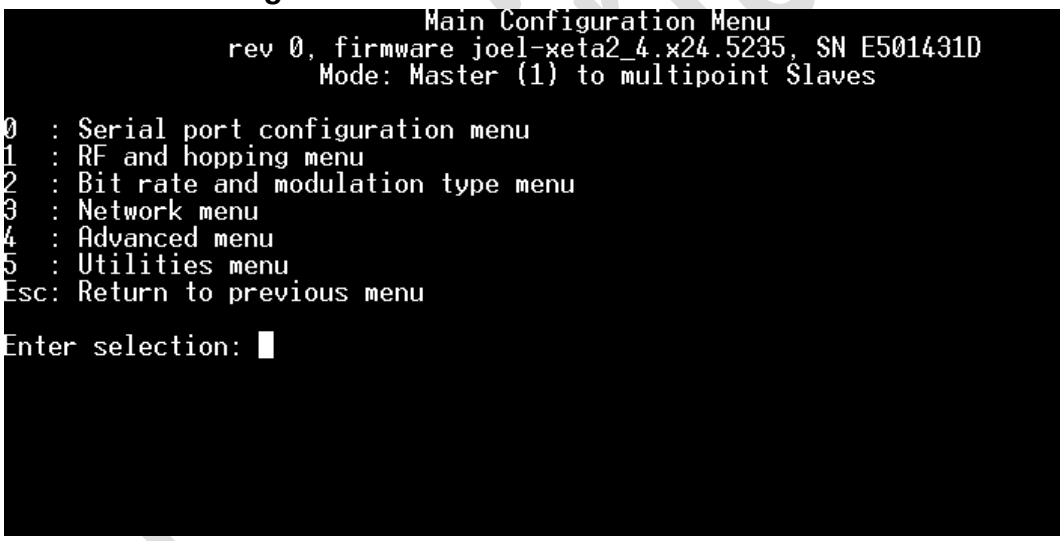


2.1 Menu System

2.1.1 Operating Menu – Status Page



2.1.2 Main Configuration Menu



2.1.3 Serial Port Configuration Menu

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                        Serial Port Configuration Menu

0  : Data serial bit rate            921600 bps
1  : Data serial framing             8N1
2  : Data serial protocol            Raw
3  : Baud clock multiplier           0
4  : Data serial flow control        Disabled
5  : Serial message delay            35 bits
6  : Data serial interface           RS-232
7  : Delay after RS485 drivers on    40 bits
8  : Delay before RS485 drivers off  10 bits
9  : Seamless group                  0
     Diagnostic serial bit rate      115200 bps
Esc: Return to previous menu

Enter selection:
```

2.1.4 RF and Hopping Menu

```
                              RF and Hopping Menu

Channels:          171
Bandwidth:         309970 Hz
Frequency range:   2400491250 - 2482516250 Hz

0  : RF band                          ISM band
1  : Maximum separation               10 km
2  : MAS transmit power               0 mW
3  : MAS master transmit frequency    2420000000 Hz
4  : MAS slave transmit frequency     2420000000 Hz
5  : ISM transmit power               500 mW
6  : ISM transmit frequency           2476000000 Hz
7  : ISM hop pattern                  1
8  : ISM hop offset                   0
9  : ISM start / stop frequency
a  : ISM exclude frequency
b  : Show hop frequencies
Esc: Return to previous menu

Enter selection:
```

2.1.5 Bit Rate and Modulation Type Menu

```
                        Bit Rate and Modulation Type

This menu selects the bit rate and modulation type mode(s) to use.  Enabling
multiple modes allows the radio to switch modes as needed for best performance.
When multiple modes are enabled for a multipoint network, you can also change
the master's fixed transmit mode by selecting '>'.

0  :       57 kbps,   MSK
1  :      114 kbps,   MSK
2  :      153 kbps,   MSK
3  : *    229 kbps,   MSK
4  :      884 kbps,  BPSK
5  :     1768 kbps,  QPSK
6  :     2651 kbps,  8PSK
7  :     3535 kbps, 16QAM
8  :     3535 kbps, 16PSK
9  :     4419 kbps, 32QAM
Esc: Return to previous menu

Enter selection to enable or disable:
```

2.1.6 Network Configuration Menu

```
                            Network Configuration Menu

0  : Operating mode                 Master
1  : Network type                   Point-to-multipoint
2  : Network address                00111
3  : Upstream device address        2
4  : Downstream device address      2
5  : Maximum payload size, master   128 bytes
6  : Maximum payload size, slave    128 bytes
7  : Our device address             1
8  : Radio name
Esc: Return to previous menu

Enter selection:
```

2.1.7 Advanced Settings Menu

```
                            Advanced Settings Menu

0  : Multi-master sync mode         No sync
1  : Idle beacon period             1
2  : Dynamic payload mode           Disabled
Esc: Return to previous menu

Enter selection:
```