

# XETA4-TMFA

## User Manual

Rev. B



XETAUJAVE

CUSTOM RF SOLUTIONS

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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.

No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, or for any purpose without the express written permission of XetaWave LLC.

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 90 of the federal code. The device complies with 47CFR § 1.1310, Table 1, Limits for General Population/Uncontrolled Exposure for MPE (maximum permissible exposure) to electromagnetic fields, when installed and operated as described herein.

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 will void the user's authority to operate the device, and may result in regulatory violations and liabilities.

#### Caution

The Xeta4-TMFA has a maximum transmitted output power of 10 watts when used in compliance with FCC regulations in the 450-470 MHz frequency bands. The transmit antenna shall be kept at least 187 cm from physical space where humans may exist, based on a maximum antenna gain of 11.2 dBi. See FCC Exposure Compliance on page 4 for more details and RF exposure calculations.

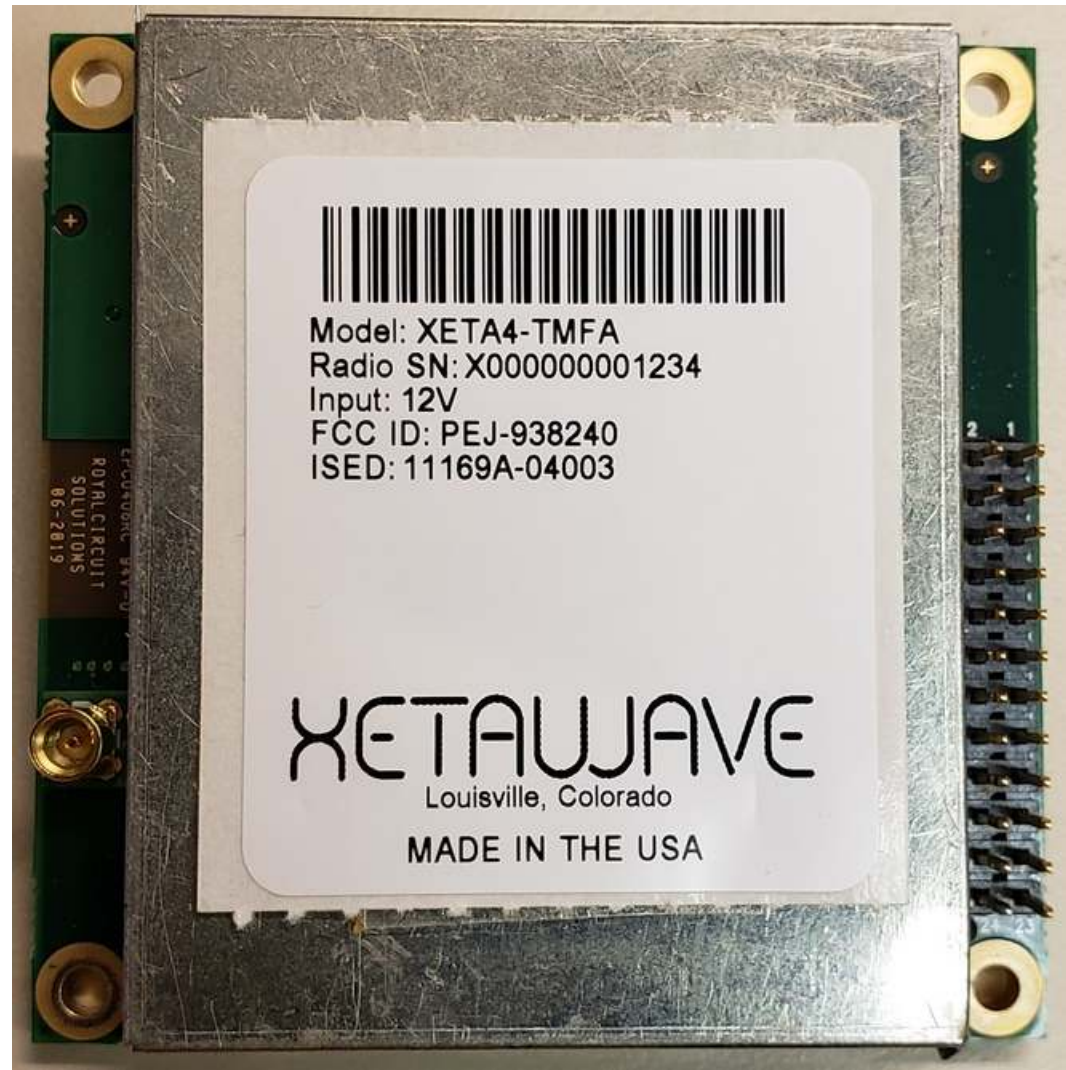
These limits are designed to provide reasonable protection against harmful energy and, if not installed and used in accordance with the instructions, may result in human exposure to excessive RF energy.

This device must be installed in a host unit provided by XetaWave, LLC for fixed installations.

### Integration FCC ID

When the module is installed inside another device, the outside of the device into which the module is installed must display a label referring to the enclosed module.

The exterior label shall use the wording: 'Contains FCC ID: PEJ-938240'.



**WARNING**

This radio module shall be installed by an RF/radio professional familiar with the applicable rules. Installation of antennas shall be performed in a manner that will provide at least the MPE Distance from any user or member of the public in the direction of maximum radiation.

Professional installers receive radios with factory preset settings in compliance with the values and limits specified in the radio certification.

While the grant may reference the full range of 450-470 MHz frequencies, we attest that this product will comply with Part 90 FCC regulations within the following frequency bands and modulations:

- 450 - 454 MHz
- 456 – 462.5375 MHz

462.7375 – 467.5375 MHz  
467.7375 – 470 MHz

### **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's RF connector to the desired antenna.

Any antenna from a reputable manufacturer with desired bandwidth, gain/pattern coverage, and a rated nominal impedance of 50 ohms, can be used.

### **FCC Exposure Compliance**

**FCC ID:** PEJ-938240

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 of the guidelines in FCC OET Bulletin 65 and 47CFR § 1.1310.

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 MPED (Maximum Permissible Exposure Distance) is calculated using the FCC limit for a general population/uncontrolled exposure in the 450 - 470 MHz frequency band.

To calculate safe distance:

$$MPED = \sqrt{\frac{(ConductedPower)(DutyCycle)(AntennaGain)}{(4\pi)(ExposureLimit)}}$$

Where:

*MPED* is Maximum Permissible Exposure Distance or safe distance in cm;

*ConductedPower* is the power delivered to the antenna in mW;

*ExposureLimit* is the limit for General Population/ Uncontrolled exposure in mW/cm<sup>2</sup>

All quantities are calculated in linear or numeric quantities.

The XETA4-TMFA transmitter duty cycle varies depending on many factors. Packet sizes, which are set up by the installer as part of the radio/network configuration, are a primary determinant. At power up and with no data payload, the radios will transmit a beacon with a duty cycle of 6 to 10%, depending upon modulation setting. The duty cycle will increase when a data payload is transmitted, but will also be influenced by network configuration, network type, number of radios in the network, propagation

delay between radios, and other factors. For the purpose of the MPED calculation, a worst case duty cycle of 100% will be assumed, although this duty cycle is not achieved in typical operation.

Integrators are responsible for including RF exposure information statements in their final user manuals.

The worst case MPED for any transmit frequency in the 450 - 470 MHz band is shown in the table in the following section.

### FCC MPE Calculation

Use: General

Antenna: 11.2 dBi

For 450-470 MHz single transmitters (for general population/uncontrolled exposure)

The worst case required separation distance in the US is 187 cm (at 450 MHz).

Frequency, MHz	EUT Power		Cable Loss, dB	Antenna Gain, dBi	Power at Antenna, dBm	EIRP, mW	Power Density (S) at 20 cm, mW/cm <sup>2</sup>	MPE Limit at 20 cm, mW/cm <sup>2</sup>
	mW	dBm						
450.0	10000	40.0	0.0	11.2	40.0	131826	26.23	0.300
470.0	10000	40.0	0.0	11.2	40.0	131826	26.23	0.313

For the cases where S > the MPE Limit

Frequency, MHz	Power Density (S) at 20 cm, mW/cm <sup>2</sup>	MPE Limit at 20 cm, mW/cm <sup>2</sup>	Distance where S ≤ MPE Limit, cm
450.0	26.23	0.300	187.0
470.0	26.23	0.313	183.0

**Industry  
Canada**

**IC**

**IC: 11169A-04003**

This device complies with Industry Canada's license-exempt RSSs. 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 présent 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, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

Cet appareil doit être utilisé comme fourni par XetaWave LLC. Toute modification apportée à l'appareil sans l'autorisation écrite expresse de XetaWave LLC peut annuler l'autorisation de l'utilisateur d'utiliser l'appareil.

In compliance with CTFA2018, users are restricted from setting the device to the following frequency bands:

En conformité avec CTFA2018, les utilisateurs sont limités à la configuration de l'appareil aux bandes de fréquences suivantes:

406.1 – 430 MHz

450 – 470 MHz

### **IC Setting**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to IC ICES-003.

This unit must be installed in a fixed location.

Cet équipement a été testé et reconnu conforme aux limites d'un appareil numérique de classe B, conformément au IC ICES-003.

Cet appareil doit être installé dans un endroit fixe.

Integrators are responsible for including RF exposure information statements in their final user manuals.

Les intégrateurs sont responsables d'inclure des instructions d'information sur la RF dans leurs manuels d'utilisation.

When the module is installed inside another device, the outside of the device into which the module is installed must display a label referring to the enclosed module.

The exterior label will use the wording: 'Contains IC: 11169A-04003'.

HVIN: XETA4-TMFA

Lorsque le module est installé à l'intérieur d'un autre périphérique, l'extérieur du périphérique dans lequel le module est installé doit afficher une étiquette faisant référence au module inclus.



L'étiquette extérieure utilisera le libellé: 'Contient IC: 11169A-04003'.

HVIN: XETA4-TMFA

### IC Exposure Compliance

**NOTE:** Integrators are required to include RF exposure information in their product user manual.

**REMARQUE:** Les intégrateurs doivent inclure les informations d'exposition RF dans leur manuel utilisateur.

Innovation, Science and Economic Development Canada MPE Calculation  
Required separation distance for Canada is 257 cm.

Innovation, Science and Economic Development Canada MPE Calculation

Innovation, science et développement économique Canada Calcul MPE  
La distance de séparation requise pour le Canada est de 257 cm.

Innovation, science et développement économique Canada Calcul MPE

Use: General

Utilisation: Généralités

Antenna: 11.2 dBi

Antenne: 11.2 dBi

For 406.1 - 470 MHz single transmitters (General use):

Pour émetteurs simples 406.1 - 470 MHz (usage général):

Frequency, MHz	EUT Power		Cable Loss, dB	Antenna Gain, dBi	Power at Antenna, dBm	EIRP, mW	Power Density (S) at 20 cm, W/m <sup>2</sup>	MPE Limit at 20 cm, W/m <sup>2</sup>
	mW	dBm						
406.1	10000	40.0	0.0	11.2	40.0	131826	262.3	1.59
430.0	10000	40.0	0.0	11.2	40.0	131826	262.3	1.65
450.0	10000	40.0	0.0	11.2	40.0	131826	262.3	1.70
470.0	10000	40.0	0.0	11.2	40.0	131826	262.3	1.75

For the cases where S > the MPE Limit:

Pour les cas où S > la limite MPE:

Frequency, MHz	Power Density (S) at 20 cm, W/m <sup>2</sup>	MPE Limit at 20 cm, W/m <sup>2</sup>	Distance where S ≤ MPE Limit, cm
406.1	262.3	1.59	257.0
430.0	262.3	1.65	252.0
450.0	262.3	1.70	248.2
470.0	262.3	1.75	244.5

## Industry Canada Antenna Compliance

The antenna used for this radio must be properly installed and maintained and must provide a separation distance of at least 257 cm (101 inches) from all persons and must not be collocated or operated in conjunction with any other antenna or transmitter. Never transmit if any person is closer than the specified distance to the antenna.

L'antenne utilisée pour cette radio doit être correctement installée et entretenue. Elle doit respecter une distance minimum de 257 cm (101 pouces) de l'utilisateur et ne doit pas être installée à proximité ou utilisée conjointement avec tout autre antenne ou émetteur. N'utilisez pas votre radio si vous ne respectez pas la distance spécifiée.

## Configuration

### Password Protection

All radios are shipped from the factory password-protected and do not allow users to set parameters outside the limits of certification. The method of password entry is hidden from the user, and the required password for each radio is generated using a unique mathematical calculation that is proprietary to XetaWave, LLC.

Users have the ability to set parameters, via the Diag port, within the permissible limits. Users do not have access to programming capability.

## Communicating with the XETA4-TMFA

### The Diag Port

The Diag port is used to configure the Xeta4-TMFA and monitor radio and network operation, data throughput, and packet error rate. Typically, the Diag port is connected to a computer or other user equipment with an RS-232 type interface and ASCII text display capability. The user's RS-232 interface may be a native serial port, or it may be implemented via an interface converter (for example, a USB-to-RS-232 converter dongle). A 3.3 volt to RS-232 level converter must be used between the radio and the user's serial port if the user's serial port requires standard RS-232 levels (typically -5 volts/+5 volts to -12 volts/+12 volts). The radio Diag port levels are 0 volts/+3.3 volts, and it is inverted with respect to standard RS-232 signaling.

The user's serial port must be configured to match the following configuration to communicate:

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

Once power is applied to the radio, the following initialization information will be displayed in the RS-232 text display window on the user's equipment:

```
interrupt_init
timer_init
crc_init()
spi_init(SPI_BUS_FLASH)
flash_init()
mfg_cals_init()
mon_init()

Xetawave Bootloader revision 1.53.19108 for Xeta4 board

Booting . . .

interrupt_init()
coresight_init()
coresight_start()
watchdog_init()
spi_init(SPI_BUS_0)
spi_init(SPI_BUS_1)
spi_init(SPI_BUS_FLASH)
flash_init()
config_init()
mfg_cals_init()
math_init()
twi_init()
iox_init()
pll_init(TRUE)
timer_init()
params_load()
synth_init()
if_init()
sport_init(SPORT_BUS_0)
sport_init(SPORT_BUS_1)
daca_init()
dac_init()
rcv_init()
xmit_init()
crc_init()
crc16_init()
math_rand_set_seed(params.serial_number)
ecc_init()
pwm_init()
radio_mode_init()
ptc_reset(FALSE)
mon_init()
Serial Ports: Data=115200:8N1; Diag=115200:8N1;
Starting . . .
```

After the initialization information appears, the operating menu will be displayed.

## Operating Menu

```
Operating Menu
XETA4-TMFA rev 0, firmware 1.53.19108, SN E50243FC
Mode: Slave (8) to Master (1)

Frequency      450006250 Hz
Xmit mode      32QAM  51 Kbps      Link state      up
Recv mode      32QAM  51 Kbps      RSSI            -78 dBm
Fwd power      10000 mW          Noise          -132 dBm
Rev power      11 mW          Xmit rate      22.5 Kbps
Supply         12000 mV          Recv rate      0.0 Kbps
Amp temp       32 C          Cur success    100.00%
Board temp     29 C          Avg success    100.00%

0 : Enter configuration/utilities menu
1 : Update radio status
2 : Reset all statistics
3 : Enable or disable automatic status updates

Enter selection:
```

If the characters are garbled, or nothing is displayed, then it is likely that the user's serial port does not match the radio's serial port or the proper converters may not be in use. The radio is shipped from the factory configured for 115200 Baud. This value can be configured differently by the factory upon customer request. If the radio has had settings changed from the factory settings, then you may need to try different computer baud rates to find the match with the radio.

This screen displays the current configuration of the radio. It is important to note the third line, which shows the Mode (Master/Repeater/Slave) of the radio and the mating radio on the other side of the link and the device addresses of the two radios making the link. In the above example, the radio is a Slave unit (address 8) and will link with a Master unit (address 1).

### Options:

- Enter "0" to display the configuration settings and utilities menu.
- Enter "1" to refresh all displayed parameters to current values.
- Enter "2" to reset the packet rate success statistics to 100%.
- Enter "3" to turn on or off automatic refreshing of displayed parameters.

### Configuration/Utilities Menu

From the Operating Menu, enter "0" to view the Configuration/Utilities menu.

```
Configuration/Utilities Menu
XETA4-TMFA rev 0, firmware 1.53.19108, SN E50243FC
Mode: Slave (2) to Master (1)
```

```
0 : Serial port configuration menu
1 : RF and hopping menu
2 : Bit rate and modulation type menu
3 : Network menu
4 : Advanced menu
5 : Utilities menu
Esc: Return to previous menu
```

```
Enter selection:
```

### Serial Port Configuration

To modify the data serial port, enter "0" to access the Serial Port Configuration menu.

#### Serial Port Configuration Menu

```
0 : Data serial bit rate          115200 bps
1 : Data serial framing           8N1
2 : Data serial protocol         Raw
3 : Baud clock multiplier        0
4 : Data serial flow control     Enabled
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
a : Modbus group                 0
Diagnostic serial bit rate       115200 bps
Esc: Return to previous menu
```

```
Enter selection:
```

Each radio has two serial ports for communication; one is a lower speed diagnostics port and the second is a high speed data port. These ports are RS-232 type, with input/output voltage levels of 0 volts/+3.3 volts. A 3.3 volt to RS-232 level converter is required to communicate with standard RS-232 serial port devices, including computers. The ports are typically configured as 8 bits of data with no parity and 1 stop bit by default. The diagnostics port has no provision for hardware flow control. The data port is typically used with hardware flow control, although flow control can be disabled in the serial port configuration menu.

The standard **diagnostics port** configuration is 115.2 Kbps, 8 data bits, no parity, 1 stop bit, and cannot be changed by the user. The **data port** configuration is editable through

this menu. In order to successfully communicate between the radio and another device, the device's serial port must have the same configuration as listed in this menu.

In the example shown above: Baud rate is set to 115200 bps. Data bits, parity, and stop bits are given by the three characters in the Data serial framing field. In this example, there are 8 data bits, no parity, and 1 stop bit. The flow control should always be set to hardware.

**Options:**

- Enter "0" to modify the baud rate. If a custom bit rate is entered, the radio will select the nearest achievable rate.
- Enter "1" to modify the serial framing on the data port.
- Option "2" is used only with the Ethernet option and should be left as "Raw" for normal radio operation.
- Enter "3" to modify the baud clock output that is synchronous with the data serial port. The output clock may be used to synchronize the user hardware to the radio clock for ease of serial port interface but is not required.
- Enter "4" to enable or disable hardware flow control for the data port. Usually, hardware flow control should be enabled.
- Enter "5" to set the serial message delay for message-oriented protocols. This parameter is not used for the Raw serial protocol.
- Enter "6" to set the physical data port serial interface type. This parameter should be set to RS-232 for a standalone radio module.
- Options "7" through "a" are not used for RS-232 with Raw serial protocol.
- The diagnostic port serial baud rate is shown for reference but is not adjustable in the field.

**Baud Rate**

To change the baud rate for the data port, enter "0" in the Serial Port Configuration menu. The various speeds will be displayed:

### Data Serial Bit Rate

This parameter specifies the serial bit rate in bits/second for the data port.

Current selection: 115200 bps

0	:	1200 bps	b	:	1049479 bps
1	:	2400 bps	c	:	1259375 bps
2	:	4800 bps	d	:	1574219 bps
3	:	9600 bps	e	:	2098958 bps
4	:	19200 bps	f	:	3148438 bps
5	:	38400 bps	g	:	Enter a bit rate
6	:	57600 bps			
7	:	115200 bps			
8	:	230400 bps			
9	:	460800 bps			
a	:	921600 bps			

Esc: Return to previous menu

Enter selection:

Care must be taken when changing the baud rates since the baud rate of external user equipment must match the rate setting of the radio. Also, the maximum rated baud rate of external RS-232 level shifters or protocol converters (for example, RS-232 to USB converters), which are used to interface the radio to user equipment, should be considered.

### Data Serial Framing

To configure the data serial framing, enter "1" in the Serial Port Configuration menu.

The following are examples of valid inputs:

7E1  
8O2  
5N1.5  
8N1

The first character represents data bits and can be set from 5 – 8. The second character represents parity and can be set to N, O, or E for none, odd, or even. The last character represents stop bits and can be set to 1, 1.5, or 2.

### RF Configuration

This menu allows for the selection of the frequency characteristics of the radio and can be accessed from the main configuration menu by entering menu option "1".

Menu for 406.1 – 430 MHz and 450 - 470 MHz band operation:

```
RF and Hopping Menu

Bandwidth: 12500 Hz

0 : RF band MAS band
1 : Maximum separation 10 km
2 : MAS transmit power 10000 mw
3 : MAS master transmit frequency 460000000 Hz
4 : MAS slave transmit frequency 465000000 Hz
c : Error correction Disabled
Esc: Return to previous menu

Enter selection:
```

RF Configuration Menu option “0” is non-adjustable and indicates that the radio is usable only in the 406.1 – 430 MHz and 450 – 470 MHz licensed frequency range.

### Maximum Separation

RF Configuration Menu option “1” is the distance between the master unit and the farthest slave (or repeater) unit that is connected to the master. The specified distance sets the delay for receiving an ACK from a slave and determines the propagation delay. Generally, network data rates are slower when distance increases. A short distance will have less delay and a higher throughput. However, setting this parameter to a value that is less than the actual separation can result in higher error rates. **Important:** this parameter must be the same for all radios in a given network.

```
Maximum Separation

This parameter specifies the maximum distance in km between radios.
Larger values result in lower throughput due to time allocated for
propagation delay.

Current value = 10 km

Enter new value (0 - 200) or Esc to exit:
```

### RF Transmit Power (“MAS transmit power”)

RF Configuration Menu option “2” is used to set the transmit power (in milliwatts) of the radio within the limits of the radio certification. This parameter sets the power as measured at the radio connector and does not compensate for any interconnecting cable loss, antenna gain, or power lost due to impedance mismatch from the connected load. The transmit power is dynamically adjusted to maintain this value as conditions change within the limits set. Additionally, thermal monitors continuously measure the output amplifier of the radio and can reduce the power level if the temperature rises above a predefined set limit.



#### Transmit Power

This parameter specifies the desired transmit power in milliwatts.

Current value = 10000 mW

Enter new value (1 - 10000) or Esc to exit:

#### **Master Transmit Frequency (“MAS master transmit frequency”)**

RF Configuration Menu option “3” is used to set the master transmit frequency (in Hertz) of the radio within the limits of the radio certification. If the radio is a master, then this is the frequency that it will use to transmit all messages to the slave(s). If the radio is a slave, then this is the frequency that it will use to receive messages from the master.

#### MAS Master Transmit Frequency

This parameter specifies the transmit frequency in Hz (or MHz) to use in the MAS band for the master radio. A slave radio uses this as its receive frequency. This parameter is ignored in the ISM band.

Current value = 460000000 Hz

Enter new value (406100000 - 470000000) or Esc to exit:

If a three digit number (with or without a decimal point and additional digits of precision) is entered, the radio will interpret the entry as the frequency in MHz.

#### **Slave Transmit Frequency (“MAS slave transmit frequency”)**

RF Configuration Menu option “4” is used to set the slave transmit frequency (in Hertz) of the radio within the limits of the radio certification. If the radio is a master, then this is the frequency that it will use to receive messages from the slave(s). If the radio is a slave, then this is the frequency that it will use to transmit all messages to the master.

#### MAS Slave Transmit Frequency

This parameter specifies the transmit frequency in Hz (or MHz) to use in the MAS band for the slave radio. The master radio uses this as its receive frequency. This parameter is ignored in the ISM band.

Current value = 465000000 Hz

Enter new value (406100000 - 470000000) or Esc to exit:

If a three digit number (with or without a decimal point and additional digits of precision) is entered, the radio will interpret the entry as the frequency in MHz.