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RV-M21 *Tech Series*

M21 UHF,VHF, 220MHz Band
500mW-5W Radio Modem

The RV-M21 Radio Modem is a rugged, modular data radio modem available in UHF, VHF, and 220MHz band. With its field-configurable I/O interface, the M21 can be configured for RS-232, RS485, USB, GPIO or Audio interfaces in the lab or in the field as needed. It is over-the-air compatible with Raveon's 5-watt RV-M7 series of data radios.

Product Overview

Reconfigurable I/O

The front interface of the ***Tech Series*** M21 is fully field-reconfigurable. The following front panel interfaces are available and interchangeable:

- RS-232 [S] 5T835
- USB [U] 5T837
- RS-485 [T] 5T836-1
- RS-422 [F] 5T836-2
- GPIO [G] 5T833
- Analog [A] 5T838

Embedded M8 Modem

The M21 embeds within the enclosure an M8 wireless modem. Any M8 series modem may be inserted into the M21 chassis, giving the M21 all the benefits and features available in the M8 series of modems. M* series modems can communicate with Raveon's M7 series modems.

Efficient Power Consumption

The RV-M21 can operate off DC input from 9-15V. Receiving, the M21 draws less than 1watt of power!

Long-Range Operation

The M21 radio modem works over 10 miles point-to-point and many miles with omni-directional antennas. All RV-M21 modems support store-and-forward repeating for wide-area coverage.

Fast Polling

The M21 transceiver has a 3 mS PLL in it, making it one of the fastest telemetry radios available, especially well-suited for polled, DNP, and MODBUS applications.

High Speed and High Efficiency

The RV-M21 operates with user-selectable over-the air data rates of 1200 to 19200bps. Faster rates for higher efficiency or lower-speed for increased communication range. Its fast-switching radio enables it to send up to 50 transmissions per second.

Secure Data

The data encryption feature may be enabled on any Tech Series data radio modem. When secure data is enabled, the M21 will encrypt transmissions using AES128 encryption. When properly managed, your wireless network use Tech Series radio modems will be secure and hacker-proof.

GPS Option

The optional internal GPS allows the RV-M21 to be a powerful Automatic Vehicle Locating (AVL) system or Time Space Position Information (TSPI) reporting device.

Arduino Option

The M21 Tech Series radios can be ordered with an optional internal Arduino processor for users to load their own custom firmware in.

Real-time diagnostics and statistics

Channel performance, RSSI, RF power, packet counters, and radio configuration are easily accessed via the serial port or remotely over-the-air

Flexible Addressing

The RV-M21 uses a 16 bit address with a 16 bit network mask, allowing for many devices to be co-located without receiving each other, as well as the creation of sophisticated network topologies.

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Part Numbering

RV-M21O<G>-BBB<-E>

- Case Upgrade
- Band (See RF Specs Page)
- GPS Option
- I/O Option

General Specifications

Size:
5.75" X 2.75" X .90"
Weight:
12 oz
Input Voltage:
9-15V DC
Power Consumption:
Transmitting data: <1500mA at 12.0V input
Receiving: <70mA at 12V input
Sleep: <100uA
Data Rate:
512 – 19200 bps
Serial Baud Rate:
1200 – 115200 baud
Full Spec Operating Temperature range
-30°C to +60°C

Standby to TX turn-around time
<5mS
Over-the-air Protocols
Raveon Data Radio: 1200 – 19200 bps
POCSAG RX: 512, 1200, 2400

Security

Encryption Method.....*AES128*
Electronic Serial Number.....Silicon ESN
Configuration Monitor.....Serialized on update

Transmitter Specifications

See the appropriate M8 Data Modem data sheet for specific details. Typical specifications are as follows:

RF Power Output.....*500mW – 5W (programmable)*
TX Spurious outputs.....< -70dBc
Frequency Stability.....*Better than ±1.5ppm*

Receiver Specifications

RX sensitivity (.1% BER).....9600bps, < -108 dBm
4800bps, < -113 dBm
1200 & 2400baud, < -116 dBm
RF No-tune bandwidth.....20 MHz
RF No-tune bandwidth (VHF).....24 MHz

Interface Option Connections

RS-232 Interface Port

Connector Type	DB-9 female
IO Voltage Levels	RS-232

RS-485 Interface Port

Connector Type	Phoenix 6-pin
IO Voltage Levels	RS-485

USB Interface Port

Connector Type	Mini B

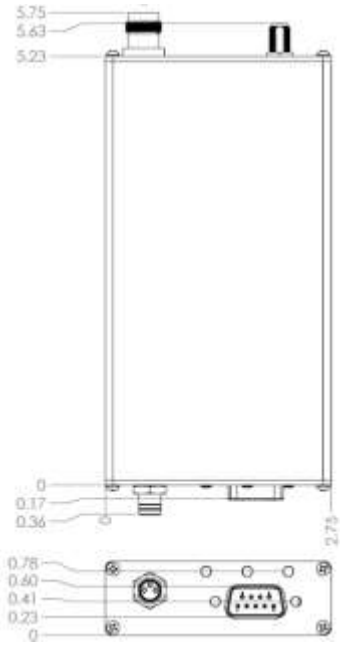
Analog Interface Port

Connector Type	DB-15 female

GPIO Interface Port

Connector Type	Phoenix 6-pin

Dimensions



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RF Specifications

BAND Numbers

BBB = Band Options:

- **UA**: 400-434 MHz / 34 MHz
- **UB**: 419-440 MHz / 21 MHz
- **UC**: 450-480 MHz / 20 MHz
- **UD**: 470-512 MHz / 20 MHz
- **VA**: 132-155 MHz / 23 MHz
- **VB**: 150-174 MHz / 24 MHz
- **VC**: 216-222 MHz / 2 MHz
- **VM**: 150-174 MHz MURS Channels only
- *Custom bands available upon request*

Bandwidth Options:

- **[Blank]:** 12.5 kHz
- **W**: 25 kHz

* Specify lower and upper frequency when ordering

General Specifications

Input Voltage:
9-15V Pre 2018. 9-24V 2018 and beyond models

Power Consumption:
Transmitting data: <1900mA at 12.5V input
Receiving: <120mA at 12V input

Data Rate:
512 – 19200 bps

Serial Baud Rate:
1200 – 115200 baud

Full Spec Operating Temperature range
-30°C to +60°C

Standby to TX turn-around time
<5mS

RF I/O Connector
MMCX Female

Transmitter Specifications

RF Power Output	500mW – 5.0W
Maximum Duty Cycle	100% (cooled)
TX Spurious outputs	*< -70dBc*
Occupied Bandwidth	*Per FCC, IC*
12.5kHz FCC Emissions Designator	*11K0F1D*
25kHz FCC Emissions Designator	*11K0F1D*
Frequency Stability	*Better than ±1.5ppm*

Receiver Specifications

Data RX sensitivity (.1% BER) 9600bps	< -108dBm
4800bps	< -113dBm
1200 & 2400baud	< -116dBm
POCSAG decoder, 512 baud	<-118dBm
RF No-tune bandwidth	20MHz
Adjacent Channel Selectivity 12.5kHz	-55dB
Adjacent Channel Selectivity 25kHz	-60dB
Alternate Channel Selectivity	-65dB
Blocking and spurious rejection	-75dB
RX intermodulation rejection	-70dB

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SCADA and Remote Control Features

Build into the M21 modems are many features and commands that can be used for SCADA, telemetry, and remote control without having to attach an external sensor.

For many SCADA systems, the Tech Series GPIO interface is the ideal interface to monitor remote devices or control them. The ones with serial interfaces such as RS-232, USB, and RS485 can be connected to a SCADA controller or HMI to communicate with a remote Tech Series radio modem that has the GPIO interface.

The following commands in the M6 are powerful SCADA and telemetry features.

Command	Command Description	Parameters
FAILSAFE	**FAILSAFE A B** command sets the minimum message interval, and the default digital output state if an over-the-air MIMIC message is not received within the failsafe period. **A** is the minimum period in seconds, Set A to 0 to disable FAILSAFE feature. **B** is the power-on ASCII hex value of the digital outputs, and also B default values are used if the failsafe interval passes and no MIMIC messages are receive. The B values are output again if MIMIC was enabled and no messages received during the MIMIC interval.	A: Required Message Interval or interface to transmit MIMIC data (Seconds) 0 - 99999 B: Default Ascii hex value to set outputs to. 00-FF
MIMIC	MIMIC mode**. MIMIC X Y X** number of seconds to TX if input 0 is low. X=0 to disable MIMIC mode. **Y** is number of seconds between transmissions when the input 0 is high.	X: 0-255 Y:0-255
GOUT	**GOUT** Get the output bit register in hexadecimal format. Example: will return **C3** if bits 0, 1, 14, 15 are set(1) and all other clear (0).	Returns Hex value, 16 bits max.
GINP	**GINP** Get the input bit register in hexadecimal format. Example: will return **C3** if bits 0, 1, 14, 15 are set(1) and all other clear (0).	Returns Hex value, 16 bits max.
CBIT	**CBIT X** Clears output bits, **X** is hexadecimal format. Any bit in x set to 1 will cause the same output bit in the modem's output register to be cleared to 0. No bits get set. X=C3 to set bits 0, 1, 14, 15. To read the output bit register, enter **CLRBIT** with no parameter or better to use **GETOUT** command.	0-FF
SBIT	**SBIT X** Sets output bits, **X** is hexadecimal format. Any bit in x set to 1 will cause the same output bit in the modem's output register to be set. No bits get cleared. X=C3 to set bits 0, 1, 14, 15. To read the output bit register, enter SETBIT with no parameter or better to use **GETOUT** command.	0-FF
TBIT	**TBIT XX MMM** Sets output bits for a specific time, **XX** is hexadecimal format. Any bit in x set to 1 will cause the same output bit in the modem's output register to be set. **MMM** is in mS. 1000=one second, 60000=one minute,…To set bit #3 to 1 for 250mS: **TBIT 4 250** After the time expires, the bits that was st in XX is cleared to 0.	0-FF 2 – 4000000000 (2mS – 1100hours)
CNTTM	**CNTTM B SS** Configure a timer to reset the bit's binary counter. **B** is the bit number (0-15) that is being configured. **SS** is the interval number of seconds that the transition counter will be reset to 0. Set **SS** to 0 to never automatically reset the counter.	B: 0 - 15 SS: 0 - 65536
IOPIN	**IOPIN XX M** Set the GPIO bits on the Tech Series GPIO front panel to inputs or outputs. XX parameter are the hexadecimal representation of the pins being configured. M is the mode for the XX pins. Mode M values: **A**:Digital TTL Input, **B**:Digital TTL Output. **C**:Open Drain MOSFET output, **D**:DC Power switch output. **E**:Analog Input	XX=Hex 00-FF M=(A,B,C,D)

Many of these SCADA commands will work with just the M6 modem module. Some require that the M6 be inside a RV-M22 Tech series enclosure to operate. For example, if there is a desire to have a switched DC output voltage, the RV-M22 Tech Series enclosure must be utilized.

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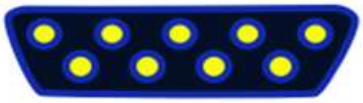
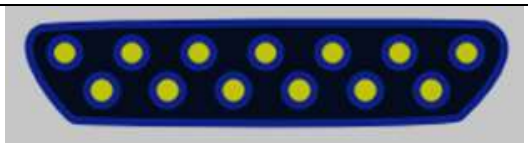
Tech Series Flexibility

The Tech Series radio enclosure from Raveon is the most flexible radio platform in the industry. 6 I/O options, 6 RF band options, GPS option, wide/narrow channels, Arduino option, and wide DC input voltage range.

I/O Connector Type	Connector Code	IO Function
	S	RS232
	U	USB
	G, T, F	GPIO RS422 RS485
	A	Analog

Raveon's Tech Series enclosures are the radio modem enclosures referred to as RV-M21 and RV-M22 part numbers. The Series enclosures have many different I/O options:

RS-232 [S], USB [U], RS-485 [T], RS-422 [F], GPIO [G], Analog [A]

MIMIC Mode

The MIMIC mode in the M6 radio module enables two modems to monitor or remotely control external devices without any additional software or devices. MIMIC mode operation takes the digital inputs from one M6 and automatically transmits them over the air to another M6 that will automatically output them.

Receiving MIMIC messages over the air and outputting them to the I/O pins is done by setting the AT I/O command to 1. If the radio modem used is incorporated into a Tech Series enclosure (M21 or M21), then keep the I/O mode set to 8 (ATIO 8). The MIMIC mode will be enabled automatically when the GPIO front panel of the Tech Series Enclosure is installed on the unit.

Transmitting MIMIC messages: MIMIC transmissions are enabled with the MIMIC X Y command. MIMIC 0 disables MIMIC mode and puts the unit in standard radio modem operation mode. MIMIC X Y with X and Y being any positive number will enable the MIMIC feature. The MIMIC X Y command sets the unit to transmit a MIMIC over-the-air message every X seconds when INPUT0 is low, and to every Y seconds when INPUT0 is high.

If the radio modem is receiving inbound data over the air when it comes time to transmit the MIMIC data, it will wait until the reception is over, and then send the MIMIC data.

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