TAPCO
Safe travels.

RADIO 148221 USER GUIDE

VERSION 0.1

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Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

RADIO 148221 TRANSCEIVER

The compact Radio 148221 900MHz transceiver replaces miles of cable in harsh industrial environments. Using field-proven FHSS technology, which needs no additional FCC licensing in the Americas, OEMs can easily make existing systems wireless with little or no RF expertise.

OVERVIEW

The Radio 148221 is a cost effective, high performance, frequency hopping spread spectrum (FHSS) transceiver designed for integration into OEM systems operating under FCC part 15.247 regulations for the 900 MHz ISM band.

Radio 148221 transceivers operate in a Masterless architecture. The Radio 148221 instead uses a Timekeeper to synchronize the network. The Timekeeper can be selected manually or the network can use built in a.i. to pick a timekeeper. Timekeeper can act as a pseudo gateway in order to synchronize signals or devices can communicate directly to one another when synchronization is not necessary.

All Timekeeper devices broadcast an RF sync pulse on periodic intervals along with timing information for secondary io beacons that are pulsed on a digital output line.

Serial data will be routed according to the destination serial number.

Digital input signals will be broadcast and then synchronized on the timekeeper pulses.

To boost data integrity and security, the Radio 148221 uses FHSS technology with data whitening and 16bit CRC data integrity checks. Configuration data is stored in an on-board EEPROM.

All frequency hopping, synchronization, and RF system data transmission/reception is programmed in the factory and is performed by the transceiver, transparent to the OEM host.

The manufacturer is responsible for ensuring the final product meets all appropriate regulatory agency requirements listed herein before shipping any product.

Note: Unless mentioned specifically by name, the Radio 148221 modules are referred to as the radio or transceiver. Individual naming is used to differentiate product-specific features.

The host (any device to which the Radio 148221 is connected, such as a PC) are referred to as OEM host.

FEATURES

- Standard IO - One digital input, 2 digital output lines, host serial lines for OTA serial.
- Options - 10 additional IO/serial communication lines are available for customization via custom factory firmware modification.
- Standard RF data rate options for 1Watt mode
  - *123kBaud
- Serial data rate is 19,200Baud.
- Green LED signaling RF Transmission and Timekeeper Beacons.
- RED LED signaling RF Packet Reception.

Ratings

- Operating Temperature -40 to 80C
- Operating Voltage 5VDC at Vin relative to ground
- Operating Voltage on all io/serial lines is 0V to 3.3V DC.
- Operating Humidity < 90%
- When operating outdoors use an appropriately rated enclosure to prevent moisture from contacting the module.
- RF Output Maximum 1Watt
- RF Frequency range >= 902.4MHz and <= 927.6MHz

Available Antennas

1. 5.15dBi Halfwave OMNI Fiberglass
2. 3dBi Omni Whip antenna - RPSMA
3. 4dBi Omni Low Profile 'Puck' shaped Antenna
4. 10.65dBi Yagi

FCC INFORMATION

FCC-Approved Antennas

NOTICE

- This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
- Radio 148221 Module may be used only with Approved Antennas that have been tested with this module.

Warnings

- Radio 148221 is intended to be installed in a fixed location.
- A minimum separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons.
- Radio 148221 will be sold with fixed power levels respective of the antenna that is provided and network data rate that is programmed into the radio by the manufacturer.
- The user shall not make changes or modifications to Radio 148221 unless expressly approved by TAPCO or the consequences could void the user's authority to operate the equipment.

FCC ID: 2ANWN-RM148221

This device complies with part 15 of the FCC Rules. 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.

The host device in which the module is installed shall have on its label, the statement "Contains FCC ID: 2ANWN-RM148221" or if an electronic display is used, it will be available without need of password protection and will be available in less than 3 steps from the main menu.

The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host and is not covered by the modular transmitter grant of certification.

Industry Canada IC ID: 25608-RM148221

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 autorisee aux deux conditions suivantes:
   - l'appareil ne doit pas produire de brouillage, et
   - l'utilisateur de l'appareil doit accepter tout brouillage radioelectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement

The host device in which the module is installed shall have on its label, the statement "Contains IC: 25608-RM148221" or if an electronic display is used, it will be available without need of password protection and will be available in less than 3 steps from the main menu.

Installation Instructions

To satisfy ISED Canada RF exposure requirements, Radio 148221 must be used at a distance of greater than 20cm from the user, with the following exceptions:

- Radio 148221 requires a minimum separation distance of 24cm when used with the Yagi antenna
- Radio 148221 requires a minimum separation distance of 22cm when used with the Whip dipole antenna

HOOKUP AND LAYOUT

Ratings	Min.	Nom.	Max.
Vin	4.5V	4.8V	5.2V
Din1	0V	-	3.3V
Dout1/2	0V	-	3.3V
TermTx/Rx	0V	-	3.3V
RSSI	0V	-	3.3V

Din1 is a Schmitt Trigger Input with min active Low voltage 0.7V and Active High voltage 2.5V.

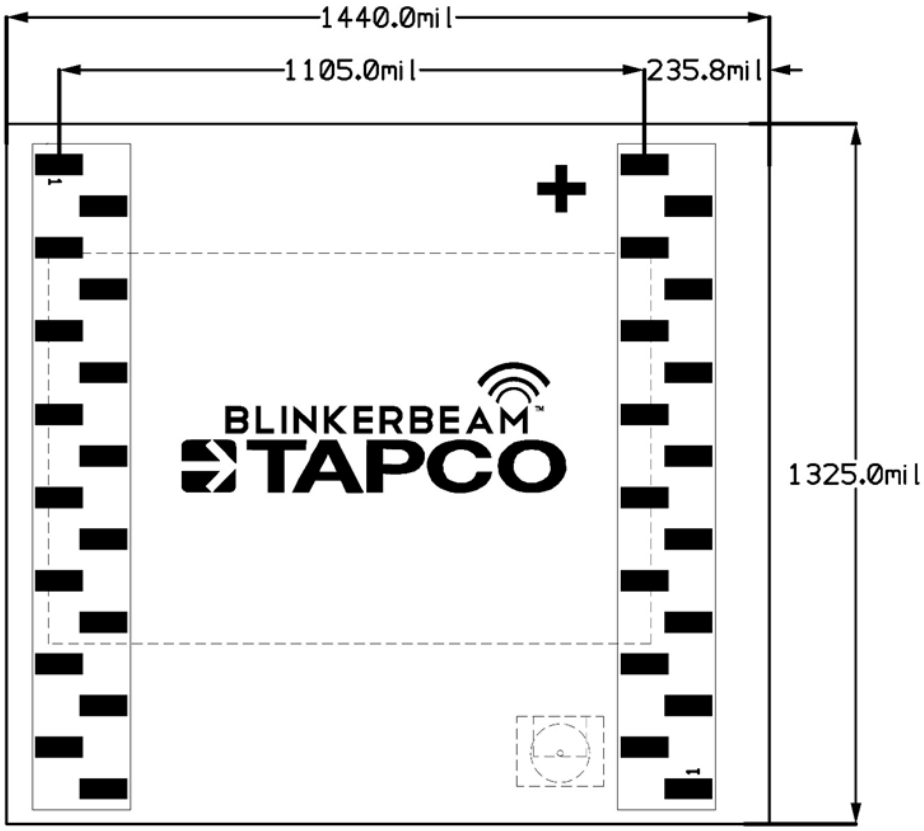
Dout1/2 are push pull outputs.

RSSI uses 8bit 1 start 1 stop bit active low 460,800baud to transmit RSSI information in ascii format.

TermTxRx uses 8bit 1 start 1 stop bit active low 19,200baud to transmit and receive serial data over the air.

TermTx is in reference to the Host TX and TermRx is in reference to Host Rx.

HOST LAYOUT



TAPCO suggested Host layout using Samtec SMM-116-02-S-S

*Host layout may use any 2mm pitch connector suitable for mating with Samtec TMM-116-01-S-S-SM.

Frequency Hopping Spread Spectrum

A FHSS radio does just what its name implies – that is, it 'hops' from frequency to frequency over a wide band. The specific order in which frequencies are occupied is fixed but in a pseudo random order.

Modes of Operation

The Radio 148221 has 4 operating functions:

- Transmit serial data
- Receive serial data
- Hardware IO control
- Hardware Beacon outputs

Hardware IO mode acts like a one to many remote controls so when Digital input one on any device is activated, the radio broadcasts this information to all other radios on a synchronized beacon. When a remote device receives information that one of the other radios Digital Input 1 has been activated, it activates its Digital Output 1.

Hardware Beacon outputs are configurable at the factory to output a beacon pulse on Digital Output 2 in any 1 second period increment. The Fundamental System Timekeeper generates the timing for this pulse and keeps Listener radios updated as to the status of this Hardware Beacon Pulse.

Serial Data Received on any radio will be directed to the remote radio device that is getting addressed by the host application.

Local Serial Data received for device configuration will not be transmitted on the RF network.

Transmit Mode

All packets sent over the air are either Addressed or Broadcast packets. Broadcast and Addressed delivery can be controlled dynamically with the API Control byte. Contact the factory for details.

When a radio has data to transmit, it sends it out on its reserved timeslot. The number of devices on a network is configurable at the factory.

To increase the odds of successful delivery the host application is required to Transmit Retries.

RF Serial Communication is not transparent to the OEM host and the Manufacturer will need to advise the Host on how to apply data packaging for transmission OTA (over the air). Contact the factory for details.

Receive Mode

Serial data can be asynchronously received by Radio 148221 OTA then directed to the Host serial port.

RSSI - Received Signal Strength

RSSI is in units of dBm and is available through serial communication. Contact the factory for details on reading this information from the transceiver.

System Timing and Latency

Latency is the amount of time that it takes for an action to take place. There are different actions available in TapNet including remote digital control and serial data transmission/reception.

IO latency is dependent on the size of the RF network.

7 Device networks require a maximum of 62.5ms for one transceiver to transmit information to the system and in as little as 9ms to transmit information directly.

16 Device networks require a maximum of 143ms for one transceiver to transmit information to the system and in as little as 9ms to transmit information directly.

System Throughput

Maximum System Throughput

- Timekeeper to Listener = 1280 baud continuous max host throughput rate
- Listener to Listener in direct mode = 1280 baud continuous max rate
- Listener to Listener in sync mode = 640 bytes baud continuous
- Maximum host serial payload size is 64 bytes.
- RF Data Rate default is 123kBaud.

Other data rates and payload sizes are available. Contact TAPCO for details on custom serial data configurations.

System Operation

The Radio 148221 network is preconfigured at the factory so all the user needs to do is power up the devices and they will automatically sync and begin working. IO and OTA serial functionality is only available once a device is sync'd.

A flashing green LED indicates the TimeKeeper device. The Green LED specifically indicates that data has been transmitted OTA.

A red flashing LED indicates that a Listener Device is in sync with the TimeKeeper. The Red LED specifically indicates that RF data has been received OTA.

ORDERING INFORMATION

This radio transmitter 25608-RM148221 has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Product Part Number: Radio 148221 – Radio Transceiver Module, High Power

Available Antennas:

Antennas:

- TAPCO Part No: 146299, Max 4dBi 50 Ohms, Dome Style Antenna Kit with 24" COAX
- TAPCO Part No: 101962, Max 3dBi 50 Ohms, Whip Antenna
- TAPCO Part No: 149096, Max 5.15dBi 50 Ohms, Halfwave Omni Base Station Antenna

Antenna Accessories:

- Lightning Arrestor, L-com Model AL-NFNFB
- L-Com Cable Model CA-RSPNMA002

Product Part Number: Radio 148221_149095 - Radio Transceiver Module, Medium Power

Available Antennas:

Antennas:

- TAPCO Part No: 146299, Max 4dBi 50 Ohms, Dome Style Antenna Kit with 24" COAX
- TAPCO Part No: 101962, Max 3dBi 50 Ohms, Whip Antenna
- TAPCO Part No: 149096, Max 5.15dBi 50 Ohms, Halfwave Omni Base Station Antenna
- TAPCO Part No: 1343-00006, Max 10.65dBi 50 Ohms, Yagi Antenna

Antenna Accessories:

- Lightning Arrestor, L-com Model AL-NFNFB
- L-Com Cable Model CA-RSPNMA002

Product Part Number: Radio 148221_MAX - Radio Transceiver Module, 1W Power

Available Antennas:

Antennas:

- TAPCO Part No: 146299, Max 4dBi 50 Ohms, Dome Style Antenna Kit with 24" COAX
- TAPCO Part No: 149096, Max 5.15dBi 50 Ohms, Halfwave Omni Base Station Antenna

Antenna Accessories:

- Lightning Arrestor, L-com Model AL-NFNFB
- L-Com Cable Model CA-RSPNMA002

Radio 148221, Radio 148221_149095 and Radio 148221_MAX must be purchased with the antenna that is intended to be used in the host application.

Antennas with connectors that do not meet the requirement of a non-standard antenna connector will have an adapter permanently connected with industrial epoxy, "Loctite" or solder to make the connection permanent prior to shipping.

TAPCO is a leader in the design and manufacture of customized, performance-critical products for wireless and other advanced electronics applications. TAPCO partners with its customers to provide solutions for various applications such as:

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- Parking and Security Systems
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- Streetscape Decoratives
- Signmaking and Inventory
- Sign Post Anchoring
- Federal Applications

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1020-148221 06/08/22