



# **HumRC™ Series Evaluation Module Data Guide**

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 **Warning:** Some customers may want Linx radio frequency (“RF”) products to control machinery or devices remotely, including machinery or devices that can cause death, bodily injuries, and/or property damage if improperly or inadvertently triggered, particularly in industrial settings or other applications implicating life-safety concerns (“Life and Property Safety Situations”).

**NO OEM LINX REMOTE CONTROL OR FUNCTION MODULE SHOULD EVER BE USED IN LIFE AND PROPERTY SAFETY SITUATIONS.** No OEM Linx Remote Control or Function Module should be modified for Life and Property Safety Situations. Such modification cannot provide sufficient safety and will void the product’s regulatory certification and warranty.

Customers may use our (non-Function) Modules, Antenna and Connectors as part of other systems in Life Safety Situations, but only with necessary and industry appropriate redundancies and in compliance with applicable safety standards, including without limitation, ANSI and NFPA standards. It is solely the responsibility of any Linx customer who uses one or more of these products to incorporate appropriate redundancies and safety standards for the Life and Property Safety Situation application.

**Do not use this or any Linx product to trigger an action directly from the data line or RSSI lines without a protocol or encoder/decoder to validate the data.** Without validation, any signal from another unrelated transmitter in the environment received by the module could inadvertently trigger the action.

**All RF products are susceptible to RF interference that can prevent communication.** RF products without frequency agility or hopping implemented are more subject to interference. This module does have a frequency hopping protocol built in, but the developer should still be aware of the risk of interference.

**Do not use any Linx product over the limits in this data guide.** Excessive voltage or extended operation at the maximum voltage could cause product failure. Exceeding the reflow temperature profile could cause product failure which is not immediately evident.

**Do not make any physical or electrical modifications to any Linx product.** This will void the warranty and regulatory and UL certifications and may cause product failure which is not immediately evident.

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# HumRC™ Series Evaluation Module

## Data Guide

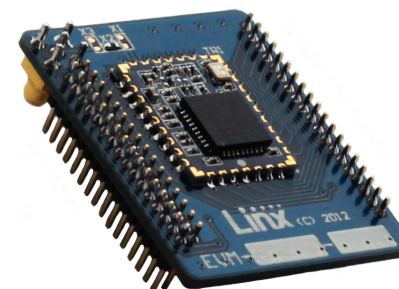


Figure 1: HumRC™ Series Evaluation Module

### Description

The HumRC™ Series transceiver is designed for reliable bi-directional remote control applications. It consists of a highly optimized Frequency Hopping Spread Spectrum (FHSS) RF transceiver and integrated remote control transcoder. The FHSS system allows higher RF output power and, therefore, longer range than narrowband radios.

Eight status lines can be set up in any combination of inputs and outputs for the transfer of button or contact states. A selectable acknowledgement indicates that the transmission was successfully received. Versions are available in the 2400 to 2483MHz frequency bands.

Primary settings are hardware-selectable, which eliminates the need for an external microcontroller or other digital interface. For advanced features, optional software configuration is provided by a UART interface; however, no programming is required for basic operation.

The evaluation module contains the surface mount HumRC™ Series transceiver module and an MMCX connector on a single board with through-hole headers. This small board simplifies prototyping with the HumRC™ Series module.

## Ordering Information

| Ordering Information |                                                         |
|----------------------|---------------------------------------------------------|
| Part Number          | Description                                             |
| EVM-***-RC           | HumRC™ Series Carrier Board                             |
| HUM-***-RC           | HumRC™ Series Remote Control Transceiver                |
| HUM-***-RC-MWA       | HumRC™ Series Remote Control Transceiver with Antenna   |
| HUM-***-RC-MWC       | HumRC™ Series Remote Control Transceiver with Connector |
| MDEV-***-RC          | HumRC™ Series Master Development System                 |
| EVAL-***-RC          | HumRC™ Series Basic Evaluation Kit                      |
| MDEV-DEMO-RC-A       | Development System Remote Control Demo Board, Type A    |
| MDEV-DEMO-RC-B       | Development System Remote Control Demo Board, Type B    |
| MDEV-PGDOCK          | Development System Programming Dock                     |
| MDEV-PROTO           | Development System Prototype Board                      |
| CON-SOC-EVM          | EVM Module Socket Kit                                   |

\*\*\* = Frequency; 900MHz, 2.4GHz

Figure 2: Ordering Information

## Absolute Maximum Ratings

| Absolute Maximum Ratings |      |    |                |     |
|--------------------------|------|----|----------------|-----|
| Supply Voltage $V_{CC}$  | -0.3 | to | +3.9           | VDC |
| Any Input or Output Pin  | -0.3 | to | $V_{CC} + 0.3$ | VDC |
| RF Input                 |      | 0  |                | dBm |
| Operating Temperature    | -40  | to | +85            | °C  |
| Storage Temperature      | -40  | to | +85            | °C  |

Exceeding any of the limits of this section may lead to permanent damage to the device. Furthermore, extended operation at these maximum ratings may reduce the life of this device.

Figure 3: Absolute Maximum Ratings



**Warning:** This product incorporates numerous static-sensitive components. Always wear an ESD wrist strap and observe proper ESD handling procedures when working with this device. Failure to observe this precaution may result in module damage or failure.

Please see the HumRC™ Series Transceiver module data guide for full electrical specifications.

## Electrical Specifications

| HumRC™ Series Transceiver Specifications |            |      |      |        |       |       |
|------------------------------------------|------------|------|------|--------|-------|-------|
| Parameter                                | Symbol     | Min. | Typ. | Max.   | Units | Notes |
| Power Supply                             |            |      |      |        |       |       |
| Operating Voltage                        | $V_{CC}$   | 2.0  |      | 3.6    | VDC   |       |
| Peak TX Supply Current                   | $I_{CCTX}$ |      |      |        |       |       |
| 2.4GHz at +1dBm                          |            |      | 28   | 29     | mA    | 1,2   |
| 2.4GHz at -10dBm                         |            |      | 19   | 20     | mA    | 1,2   |
| 900MHz at +10dBm                         |            |      | 36   | 38.5   | mA    | 1,2   |
| 900MHz at 0dBm                           |            |      | 22   | 24     | mA    | 1,2   |
| Average TX Supply Current                |            |      |      |        |       |       |
| 2.4GHz at +1dBm                          |            |      | 22   | 24     | mA    | 1,2   |
| 900MHz at +10dBm                         |            |      | 27.5 | 28.5   | mA    | 1,2   |
| RX Supply Current                        | $I_{CCRX}$ |      | 25.5 | 28     | mA    | 1,2,3 |
| Standby Current                          | $I_{SBY}$  |      | 0.5  | 1.4    | μA    | 1,2   |
| Power-Down Current                       | $I_{PDN}$  |      | 0.5  | 1.4    | μA    | 1,2   |
| RF Section                               |            |      |      |        |       |       |
| Operating Frequency Band                 | $F_C$      |      |      |        | MHz   |       |
| HUM-2.4-RC                               |            | 2400 |      | 2483.5 | MHz   |       |
| HUM-900-RC                               |            | 902  |      | 928    | MHz   |       |
| Number of Channels                       |            |      | 25   |        |       |       |
| Receiver Sensitivity                     |            |      |      |        |       | 5     |
| HUM-2.4-RC                               |            | -95  | -99  |        | dBm   | 5     |
| HUM-900-RC                               |            | -94  | -98  |        | dBm   | 5     |
| Output Power                             | $P_O$      |      |      |        |       |       |
| HUM-2.4-RC                               |            | 0    | +1   |        | dBm   | 6     |
| HUM-900-RC                               |            | +8.5 | +9.5 |        | dBm   | 6     |
| Antenna Port                             |            |      |      |        |       |       |
| RF Impedance                             | $R_{IN}$   |      | 50   |        | Ω     | 4     |
| Environmental                            |            |      |      |        |       |       |
| Operating Temp. Range                    |            | -40  |      | +85    | °C    | 4     |
| Timing                                   |            |      |      |        |       |       |
| IU to RU Status High                     |            |      |      | 50     | ms    | 7     |

1. Measured at 3.3V  $V_{CC}$   
2. Measured at 25°C  
3. Input power < -60dBm  
4. Characterized but not tested  
5. PER = 5%  
6. Into a 50-ohm load  
7. No RF interference

Figure 4: Electrical Specifications

## Pin Assignments

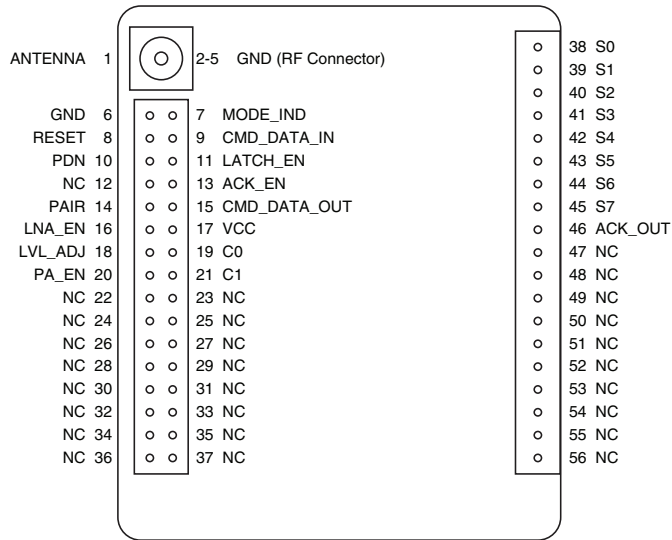


Figure 5: EVM-xxx-RC Pin Assignments

## Pin Descriptions

| Pin Descriptions |                                 |     |                                                                                                                                                                                                                                                      |
|------------------|---------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pin Number       | Name                            | I/O | Description                                                                                                                                                                                                                                          |
| 1                | ANTENNA                         | —   | 50-ohm RF Antenna Port                                                                                                                                                                                                                               |
| 2, 3, 4, 5, 6    | GND                             | —   | Ground                                                                                                                                                                                                                                               |
| 7                | MODE_IND                        | O   | This line indicates module activity. It can source enough current to drive a small LED, causing it to flash. The duration of the flashes indicates the module's current state.                                                                       |
| 8                | $\overline{\text{RESET}}$       | I   | This line resets the module when pulled low. It should be pulled high for normal operation.                                                                                                                                                          |
| 9                | CMD_DATA_IN                     | I   | Command Data In. Input line for the serial interface commands. If serial control is not used, this line should be tied to ground or $\overline{\text{POWER\_DOWN}}$ to minimize current consumption.                                                 |
| 10               | $\overline{\text{POWER\_DOWN}}$ | I   | Power Down. Pulling this line low places the module into a low-power state. The module is not functional in this state. Pull high for normal operation. Do not leave floating.                                                                       |
| 11               | LATCH_EN                        | I   | If this line is high, then the status line outputs are latched (a received command to activate a status line toggles the output state). If this line is low, then the output lines are momentary (active for as long as a valid signal is received). |

## Pin Descriptions

| Pin Number              | Name               | I/O | Description                                                                                                                                                                                                |
|-------------------------|--------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12, 22–25, 26–37, 47–56 | NC                 | —   | No Electrical Connection. Do not connect any traces to these lines.                                                                                                                                        |
| 13                      | ACK_EN             | I   | Pull this line high to enable the module to send an acknowledgement message after a valid control message has been received.                                                                               |
| 14                      | PAIR <sup>1</sup>  | I   | A high on this line initiates the Pair process, which causes two units to accept each other's transmissions. It is also used with a special sequence to reset the module to factory default configuration. |
| 15                      | CMD_DATA_OUT       | O   | Command Data Out. Output line for the serial interface commands                                                                                                                                            |
| 16                      | LNA_EN             | O   | Low Noise Amplifier Enable. This line is driven high when receiving. It is intended to activate an optional external LNA.                                                                                  |
| 17                      | VCC                | —   | Supply Voltage                                                                                                                                                                                             |
| 18                      | LVL_ADJ            | I   | Level Adjust. The voltage on this line sets the transmitter output power level.                                                                                                                            |
| 19                      | C0                 | I   | This line sets the input/output direction for status lines S0–S3. When low, the lines are outputs; when high they are inputs.                                                                              |
| 20                      | PA_EN              | O   | Power Amplifier Enable. This line is driven high when transmitting. It is intended to activate an optional external power amplifier.                                                                       |
| 21                      | C1                 | I   | This line sets the input/output direction for status lines S4–S7. When low, the lines are outputs; when high they are inputs.                                                                              |
| 38–45                   | S0–S7 <sup>1</sup> | I/O | Status Lines. Each line can be configured as either an input to register button or contact closures or as an output to control application circuitry.                                                      |
| 46                      | ACK_OUT            | O   | This line goes high when the module receives an acknowledgement message from another module after sending a control message.                                                                               |

1. These lines have an internal 20kΩ pull-down resistor

Figure 6: EVM-xxx-RC Pin Descriptions

Figure 7 shows the schematic diagram for the evaluation module.

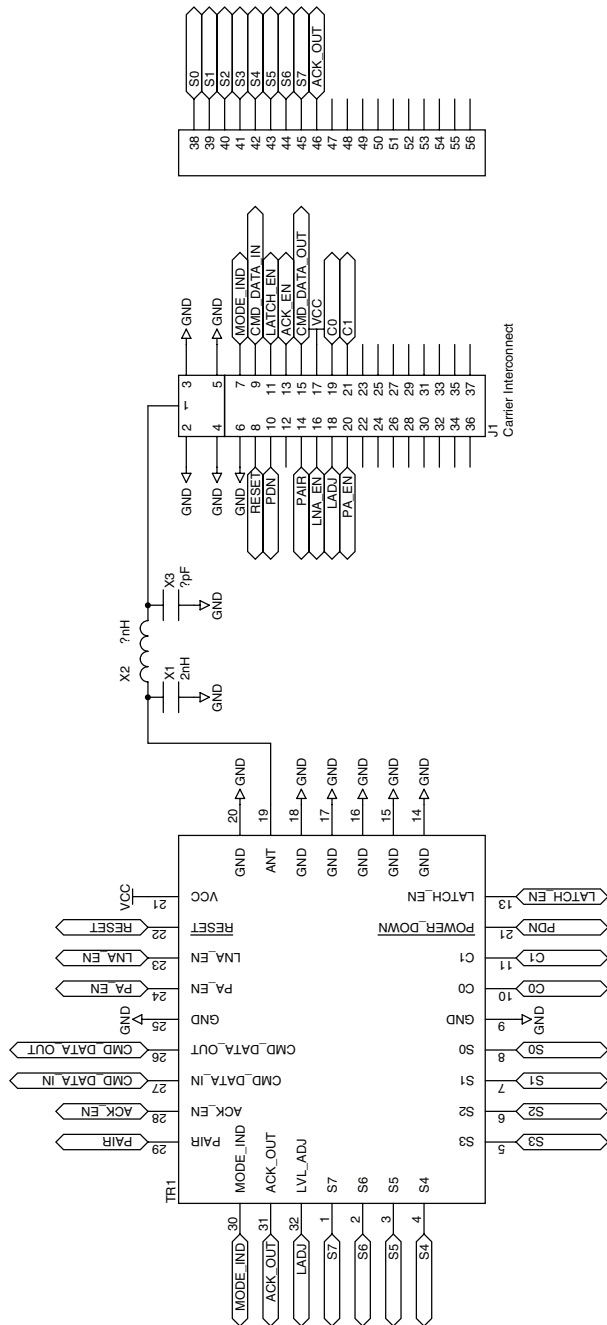


Figure 7: EVM-xxx-RC Schematic

## Pad Layout

Figure 8 shows the recommended PCB layout for the evaluation module.

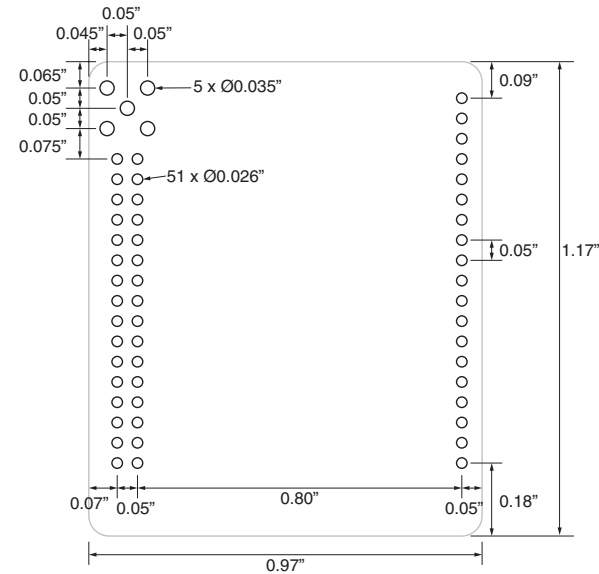


Figure 8: EVM-xxx-RC PCB Layout Dimensions

## Power Supply Requirements

The transceiver incorporates a precision low-dropout regulator which allows operation over a wide input voltage range. Despite this regulator, it is still important to provide a supply that is free of noise. Power supply noise can significantly affect the module's performance, so providing a clean power supply for the module should be a high priority during design.

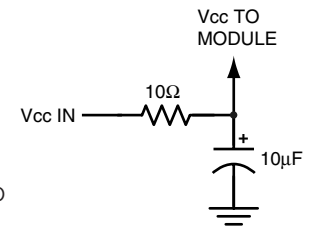


Figure 9: Supply Filter

A  $10\Omega$  resistor in series with the supply followed by a  $10\mu\text{F}$  tantalum capacitor from  $V_{cc}$  to ground helps in cases where the quality of supply power is poor (Figure 9). This filter should be placed close to the module's supply lines. These values may need to be adjusted depending on the noise present on the supply line.



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