

Vantage Controls Inc.

2240 Campbell Creek Blvd Ste #110,
Richardson, Texas, United States 75082

ETII RF V2

Installation Manual

Version 2.1
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1 OVERVIEW

The ETII RF V2 is an RF Control Board Module that contains a RF transceiver chip. It is designed to be incorporated into control devices developed by Vantage Controls Inc. The module operates under FCC approval in the 902-928 MHz ISM frequency band.

2 ETII RF V2 MODULE

2.1 SPECIFICATIONS

Specification	ETII RF V2
Performance	
Frequency Range	907.3-916.9 MHz
Transmit Power	32.6mW (15.136dBm)
Current required while transmitting	150mA
Current required while receiving	70mA
RF Communications Technology	Frequency Hopping Spread Spectrum
Number of Hop Channels	25
RF Data Rate	19200 bps
Interface Data Rates	9600-54600 bps
Antenna Gain	0- 1.58dBi
Power Requirements	
VCC	1.8 - 3.6Vdc
General	
Dimensions	3 x 18 x 27 mm (H x W x D)
Operating Temperature	-40° C to + 70° C
Humidity	5-95% RH (max), non-condensing

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2.2 PIN SIGNAL

PIN	NAME	DESCRIPTION
1	GND	Ground
2	VCC	Supply voltage
3	RF_SW2	RF switch control
4	RF_SW1	RF switch control
5	RF_DI1_INT	Digital I/O, software configured
6	RF_DI0_INT	Digital I/O, software configured
7	SPI_MOSI	SPI Data input
8	RF_RST	Reset trigger input
9	SPI_MISO	SPI Data output
10	SPI_CLK	SPI Clock input
11	SPI_NSS	SPI Chip select input
12	GND	Ground
13	GND	Ground
14	NC	Not Connected
15	NC	Not Connected
16	NC	Not Connected
17	NC	Not Connected
18	NC	Not Connected
19	NC	Not Connected
20	NC	Not Connected
21	NC	Not Connected
22	NC	Not Connected
23	NC	Not Connected
24	GND	Ground

2.3 Operating Channels

ETII RF V2 provides a wide range of channels.

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Operating Channels	Operating Frequency (MHz)
1	907.3
2	907.7
3	908.1
4	908.5
5	908.9
6	909.3
7	909.7
8	910.1
9	910.5
10	910.9
11	911.3
12	911.7
13	912.1
14	912.5
15	912.9
16	913.3
17	913.7
18	914.1
19	914.5
20	914.9
21	915.3
22	915.7
23	916.1
24	916.5
25	916.9

3 Modes of Operation

The ETII RF V2 is an RF transceiver module operating in the 902 – 928 MHz frequency band for use in Vantage devices. Power and communication with the host device is via a 24 pins header. Switches on the front may be programmed to operate various functions of the host device. The antenna gain is limited to between 0 and 2.0dBi. The transceiver operates on 25 frequencies, spaced 400 kHz apart, from 907.3MHz to 916.9MHz.

The module operates from an input 1.8-3.6VDC source. All circuitry critical to determining RF frequency or RF output power levels operate from an internally regulated 3.3V DC power source.

4 INSTALLATION

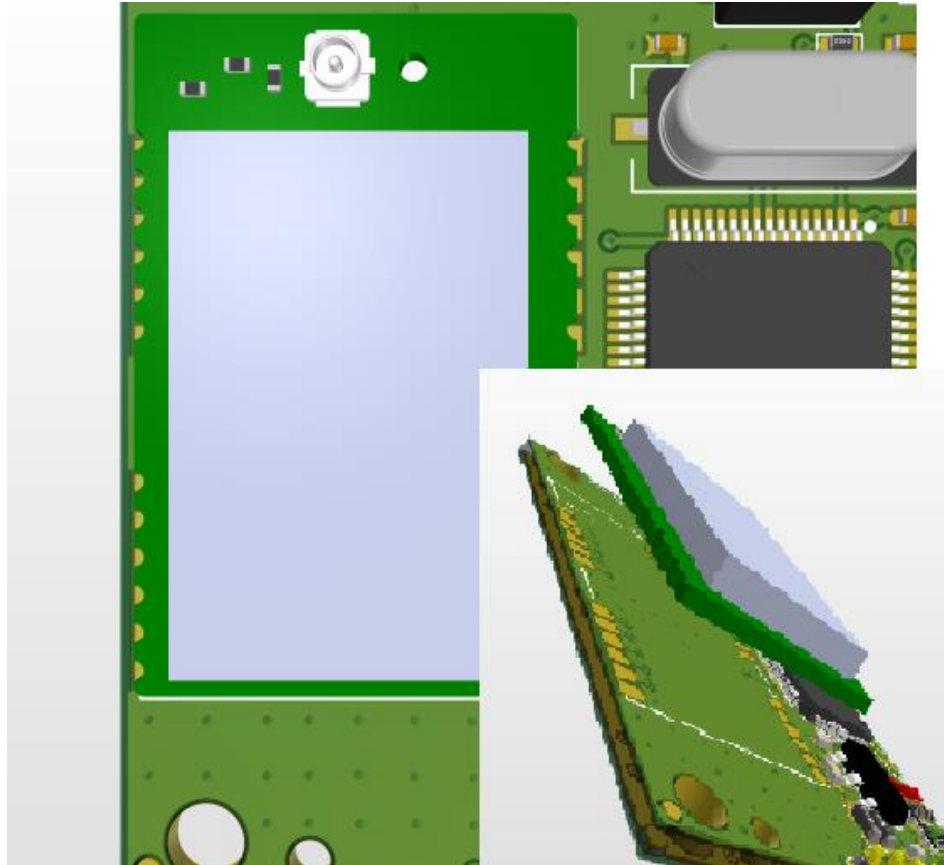
ETII RF V2 will come pre-programmed from the manufacturer, and in many cases pre-installed in a device. If you have elected to install ETII RF V2 in house, it is important to understand how to handle, install, and use properly.

4.1 DESIGN GUIDELINES

- The ETII RF V2 Module is designed to be surface mounted.
- Standard electrostatic discharge precautions should be taken when handling the module.
- The radiating structures (antenna) are away from other sensitive electronics
- No antenna modifications can be made (see section 7.0)
- FCC labeling guidelines must be maintained (see section 7.0)
- All stated electrical maximum and minimum values must be met (see section 2.1)

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4.2 END USER GUIDELINES

The module is designed to be used in fixed locations. If the end user experiences communication problems it is recommended to move the transceivers closer to one another.

Objects including, but not limited to, steel reinforced walls, metal electrical boxes, water, and snow may degrade the working distance between transceivers, and should be avoided.

FCC requires specific text to be placed within user's manual or operator instruction guide for the final commercial product. Specific details on this text can be found in section 7.0.

5 OEM LABELING REQUIREMENTS

WARNING! The Original Equipment Manufacturer (OEM) must ensure that FCC/IC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below.

Contains FCC ID: PII-31405
IC: 3505A-31405

6 INTEGRATION INSTRUCTIONS

6.1 General

The module is only approved for use by the Vantage Controls Inc in its own products and not intended for sale to third parties. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed. The Host devices also need to be evaluated via C2PC. This is internal confidential manufacturing documents.

6.2 List of applicable FCC rules

This device complies with Part 15, Subpart C, Section 15.247 of the FCC Rules.

6.3 Summarize the specific operational use conditions

The module is limited to installation in mobile or fixed applications. The module use to indoor operation, not operated on aircraft.

6.4 Limited module procedures

The module can be control by SPI. It can be set to work in different modes (Sleep, Stdbby, FS, Rx or Tx mode).The SPI interface gives access to the configuration register via a synchronous full-duplex protocol corresponding to CPOL = 0 and CPHA = 0 in Motorola/Freescale nomenclature. Only the slave side is implemented.

Operating Modes

There are three operating modes in RF module, Basic Mode, Listen Mode

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and Auto Mode.

In Basic Mode, the circuit can be set in 5 different basic modes which are described in below Table 1.

Table 1 Basic Transceiver Modes

ListenOn in RegOpMode	Mode in RegOpMode	Selected mode	Enabled blocks
0	0 0 0	Sleep Mode	None
0	0 0 1	Stand-by Mode	Top regulator and crystal oscillator
0	0 1 0	FS Mode	Frequency synthesizer
0	0 1 1	Transmit Mode	Frequency synthesizer and transmitter
0	1 0 0	Receive Mode	Frequency synthesizer and receiver

Initial RF module

Initial the registers value of RF module according to the RegistersCfg. RegistersCfg is a table defined by us.

In the RegistersCfg, basic mode is opened and output power is set to 15 dBm.

Set SensitivityBoost to High sensitivity mode to reduce the noise floor in the receiver.

Set High Power PA settings to Normal mode since High Power is not needed.

Data Processing

The module has two different data operation modes selectable by the user, Continuous mode and Packet mode. We use the Packet mode.

Packet mode: user only provides/retrieves payload bytes to/from the FIFO. The packet is automatically built with preamble, Sync word, and optional AES, CRC, and DC-free encoding schemes. In packet mode of operation, both data to be transmitted and that has been received are stored in a configurable FIFO(First In First Out) device. It is accessed via the SPI interface and provides several interrupts for transfer management.

Tx Processing: The transmission of packet data is initiated by the Packet Handler only if the chip is in Transmit mode. The Packet Handler waits until the first byte is written into the FIFO, then it starts sending the preamble followed by the sync word and user payload.

Rx Processing: When the Receive mode is enabled the demodulator receives the preamble followed by the detection of sync word. The fixed length packet format is enabled, so the number of bytes received as the payload is given by the Payload Length parameter. An interrupt (Payload

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Ready) is also generated on DIO0 as soon as the payload is available in the FIFO. The payload available in the FIFO can also be read in Sleep/Standby mode.

6.5 Trace antenna designs

Not Applicable.

6.6 RF exposure considerations

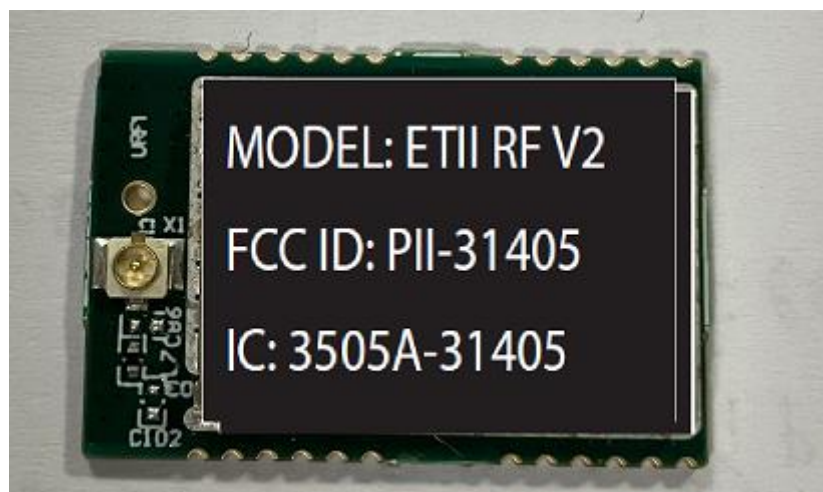
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Refer to the document "RF Exposure/Environmental Evaluation".

6.7 Antennas:

The ETII RF V2 module have only one antenna. The antenna is not trace antenna. It is monopole antenna type. The external antenna can use different antenna base on different Vantage product. but the gain is limited to between 0 and 2.0dBi.

6.8 Label and compliance information



The label is placed on the shield. Any product that incorporates this module will have a label on the outside of the enclosure that includes the following wording:

Contains FCC ID: PII-31405

IC: 3505A-31405

6.9 Information on test modes and additional testing requirements

Radio signals are tested to verify operation within acceptable parameters. These measurements are impacted by the cables and connections in the fixture as well as to the test equipment. The measurements will need to be calibrated with the “Golden Samples” to the equipment that is being used.

The UUT firmware contains test code to allow the RF signals to be tested. To use these commands the UUT must be set to RF Test Mode by using a serial command on the port connected to the SCB-68. The command 0x3F 0x0F should be sent to the UUT in 9-bit format, more information on the structure of the 9-bit format is available in the “Vantage ETII Diagnostic Serial Communication Protocol” document. Once this command has been sent, the 8-bit command format will be used for any additional commands until the station is reset or the RF Test Mode is exited.

The first RF test is at the center frequency. Using the COM port connected to the SCB-68, send a 0x01 to the UUT in 8-bit mode. The Spectrum Analyzer should be used to measure the peak amplitude and frequency for the transmitted signal. The signal should be adjusted if the center frequency is outside the limits by sending 8-bit command 0x11 with adjustment data, $((\text{Measured Freq} - 912.1\text{MHz})/500)$. The measurement should be repeated after any adjustment is made to verify the UUT is now within the allowed tolerance. If after 3 attempts the frequency cannot be adjusted to meet the defined limits the PCBA should be rejected.

Signal Description Connection Point Measurement Tolerance

Transmit Center Freq: 912.1 MHz ± 0.01 MHz

Power: 0-10 dBm

The minimum tuning frequency should now be tested. To put the UUT in this transmit mode send the 8-bit command 0x02. The peak amplitude and frequency should again be measured.

Signal Description Connection Point Measurement Tolerance

Transmit Minimum Freq: 907.3 MHz ± 0.05 MHz

Power: 0-10 dBm

Now measure the maximum tuning frequency of the UUT with the Spectrum Analyzer. To put the UUT in this transmit mode send the 8-bit command 0x03.

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The peak amplitude and frequency should again be measured.

Signal Description Connection Point Measurement Tolerance

Transmit Maximum Freq: 916.9 MHz ± 0.05 MHz

Power: 0-10 dBm

Signal modulation will be turned on and the frequency and power of the signal will be measured. The Occupied Bandwidth, OBW, will also be measured. Send the 8-bit command 0x04 to enable this mode on the UUT. The OBW can be adjusted if it is not within tolerance with the 8-bit command 0x12 with data, $((\text{Measured OBW} - 310\text{kHz}) / 2800)$. After each adjustment, measure the occupied bandwidth again to make sure it is within specification. Reject the UUT if the occupied bandwidth is outside tolerance after 4 attempted adjustments.

Signal Description Connection Point Measurement Tolerance

Occupied Bandwidth Freq: 912.1 MHz ± 0.05 MHz

Power: 0-10 dBm

Occupied Bandwidth: 310 kHz ± 5 kHz

The UUT receive sensitivity will be tested. The signal generator should be used to create a modulated signal that is centered at 912.1 MHz and has an OBW of about 300 kHz. The modulation data comes from an external source. In our fixture it comes from the microcontroller in the test fixture. The microcontroller receives a string of data from the test computer and encodes it in a modified Manchester format. It then passes the encoded data out to the signal generator, it only passes about 1Vpp signal to the generator. The data is then read from the UUT by using the 0x05 8-bit command. The returned string is compared to the transmitted string and the number of bit errors is calculated. We start this test with the power of the modulated signal set to -70 dBm on the Signal Generator.

Signal Description Connection Point Measurement Tolerance

Receive Sensitivity: PER < 30.8%

Disable RF Test Mode by sending the 8-bit command 0x06 to the UUT.

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6.10 Additional testing, Part 15 Subpart B disclaimer

All the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

6.11 Note EMI Considerations

The ETII RF V2 module was qualified installed on host device according to KDB996369 D04 Module Integration Guide. Other Host devices need to be evaluated via C2PC.

6.12 How to make changes

Not Applicable. The module is Only be used on the host devices developed by Vantage Controls Inc.

7 AGENCY CERTIFICATIONS

FCC Notice:

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.

Any Changes or modifications not expressly approved by Vantage Controls Inc 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 B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency 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 to radio or television reception, 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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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RF exposure warning

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IC Caution:

This device complies with Industry Canada licence-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 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.

RF exposure warning

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux radiations de la IC définies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps.