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RCxxxxHP-DK Demonstration Kit User Manual

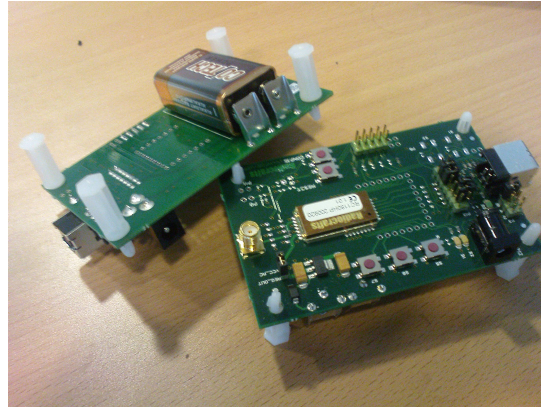


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Quick Start Guide

How do I set up a simple link between the boards?

To do a basic communication test, do like this for each of the Demonstration Boards:

- Attach the antenna to the SMA connector
- Download the latest version of RCTools from www.radiocrafts.com
- Install RCTools (this will also install the USB VCP (Virtual COM Port) driver)
- Connect the USB port to a PC
- Connect the external power supply
- Start a terminal program on the PC (RC232_CCT or Microsoft HyperTerminal program)
- Select the correct COM-port and set data rate 19200, 1 start bit, no parity, 1 stop bit, no flow control

The module will now be in idle mode listening for a valid data packet to arrive. Now you can enter data in one terminal window and after a predefined timeout, the ASCII string is transmitted to the other module and shown in the other terminal window if the transmission was successful.

How do I find the COM Port to use?

A list of all available COM-ports on your PC is found from the Windows Device manager. This is opened by "Start->Run" and type "devmgmt.msc". Alternatively, Open "System" from "Control Panel" and select the Hardware tab and click on the Device Manager button. In The Device Manager you can expand the "Ports (COM & LPT)" tab to get the list of both Standard COM ports and USB COM ports connected to your PC. For details please see the Installation Guide.

How do I go on and change the RF channel or any other parameter?

To change configurable parameters, assert the CONFIG pin (pulling low by pressing CONFIG-button, see Figure 1), and send the command string using the same serial interface as for transmitting data. Parameters can be changed permanently and stored in non-volatile memory in the module. See the User Manual for the CCT software for details on how to change settings by using this tool. The details for the configuration memory contents can be found in the RC232 User Manual, the MBUS User Manual, SIGFOX User Manual or TinyMesh™ data sheet respectively.

Why is it an USB connector when the Radiocrafts modules use a serial UART?

The benefit of USB is that power is available from the Port. The RCxxxxHPDB has an USB to UART converter from FTDI that includes a Virtual COM Port (VCP) driver that allows you to use the demo boards with any PC software that originally require a serial COM port. This means that the PC will communicate with the module using a serial connection via the virtual COM port. Both standard terminal program and the RCTools PC suite from Radiocrafts can for this reason be used together with the RCxxxxHPDK-USB. For simplicity it is recommended to first use the RCTools from Radiocrafts since the USB VCP driver is included in this installation. Details on how to use this software is available from separate User Manuals.

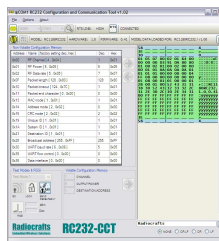


Figure 1: RC232-CCT, one of the applications in RCTools

Demonstration kit Introduction

The Demonstration Kit (DK) is designed to make it easy for the user to evaluate the onboard module, develop an application and build prototypes very quickly. The kit includes either two Demo Boards (DB) or three DBs (for TinyMesh kits). The demo board contains the selected module with its dedicated article number and embedded protocol and associated support circuits. The board can easily be operated using a PC terminal emulator or the RCTools PC suite from Radiocrafts.

Your Demonstration Kit should contain the following items:

| Kit contents | |
|--|--------------------|
| Item | Number of articles |
| Demo board w/high power radio module | 2 |
| Antenna, 50Ω quarter-wave monopole, SMA male connector | 2 |
| SMA to BNC adapters | 2 |
| USB Cable | 2 |
| AC/DC battery eliminator 6VDC | 2 |

For TinyMesh™ demo kits the number of articles is 3 of each item.

There are two different assemblies of the demo board referenced in the rest of this document depending on the article number on the onboard RF module as summarized in the table below:

| Demo Boards | RC11xxHP-DB | RC12xxHP-DB | RC17xxHP-DB | RC16xxHP-DB |
|-------------------|-------------------------------|----------------|--------------------------------------|--------------|
| Supported Modules | RC11x0HP-RC232 RC11x0HP-TM | RC12x0HP-RC232 | RC17xxHP-MBUS4 RC17xxMP-MBUS4 | RC1692HP-SIG |

This User Manual describes how to use the Demonstration Kit and provides detailed documentation for the Demonstration Board.

The Demonstration Kit includes what you need to evaluate the RF performance of the modules, develop your own application interfacing the modules, and can also be used to build a prototype of your application.

Demo Board Introduction

The Demo Board contains USB connector, USB to serial converter, buttons, LEDs, voltage regulator, configuration jumpers and connectors to make it easy to interface the onboard module with various test equipment or the host MCU used in an application. Not all components are needed in an actual application. Please see the datasheet for each specific module for a typical application circuit.

The module on the demonstration board is as default at power-up configured with a channel in the frequency band where high output power is allowed.

For RC1180HP-RC232 / -TM in particular: The allowed band for 500 mW (+27 dBm) operation is 869.400-869.650 MHz. If configured for another channel, be sure to program the maximum allowed output power according to the datasheet, never exceeding +14 dBm outside the mentioned frequency band.

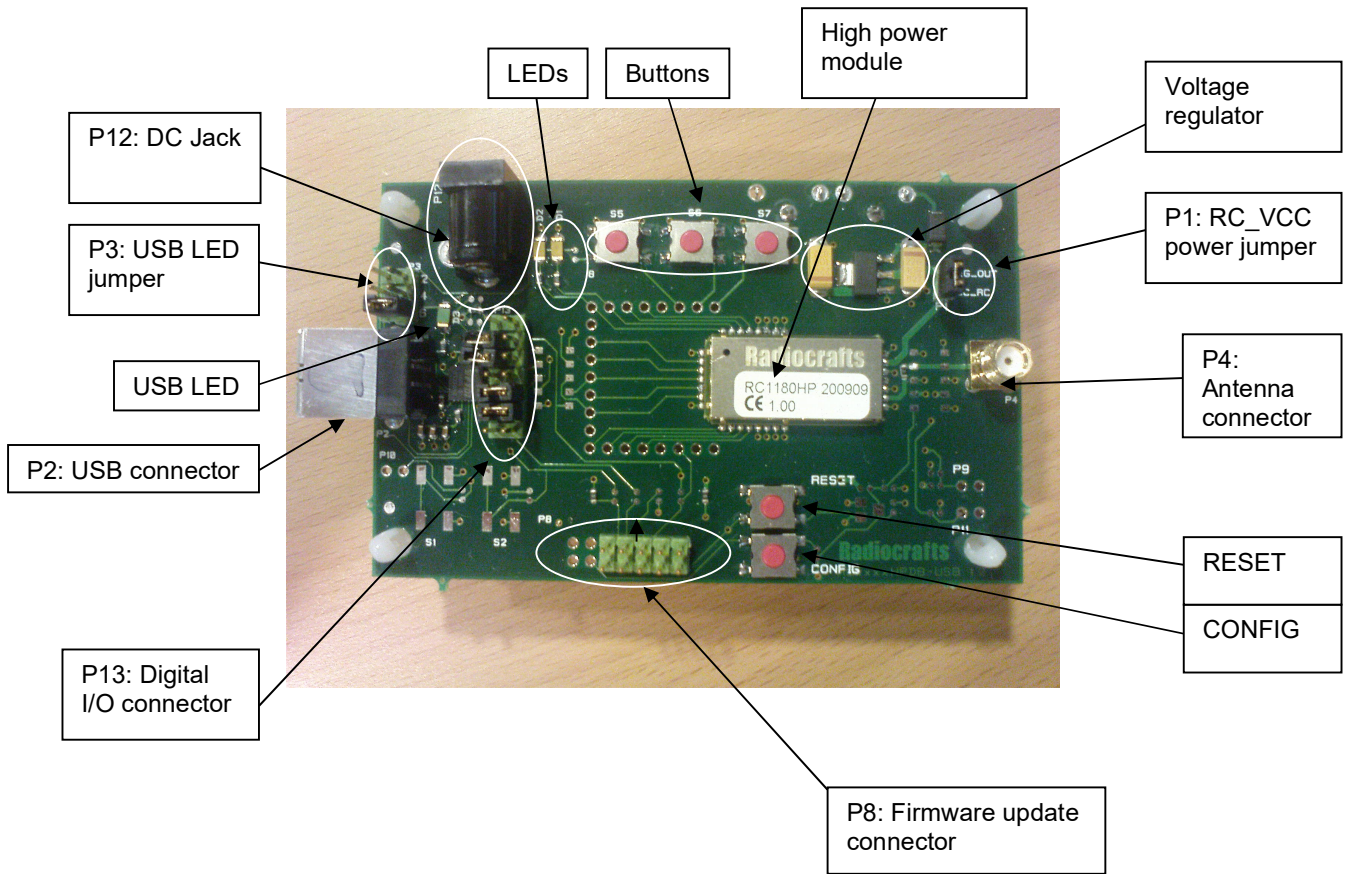


Figure 2: RC11xxHP-DB Demonstration Board

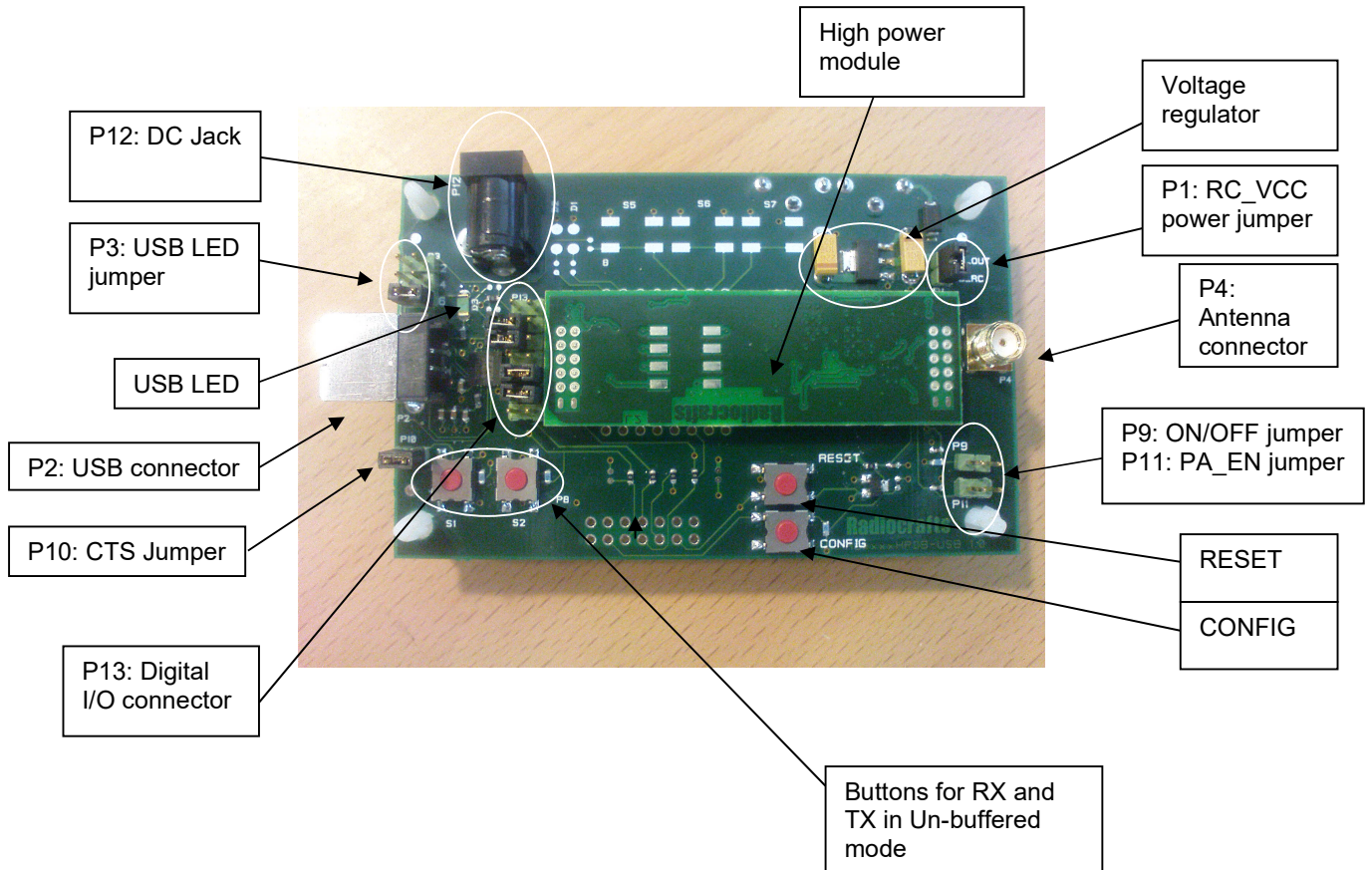


Figure 3: RC12xxHP-DB Demonstration Board

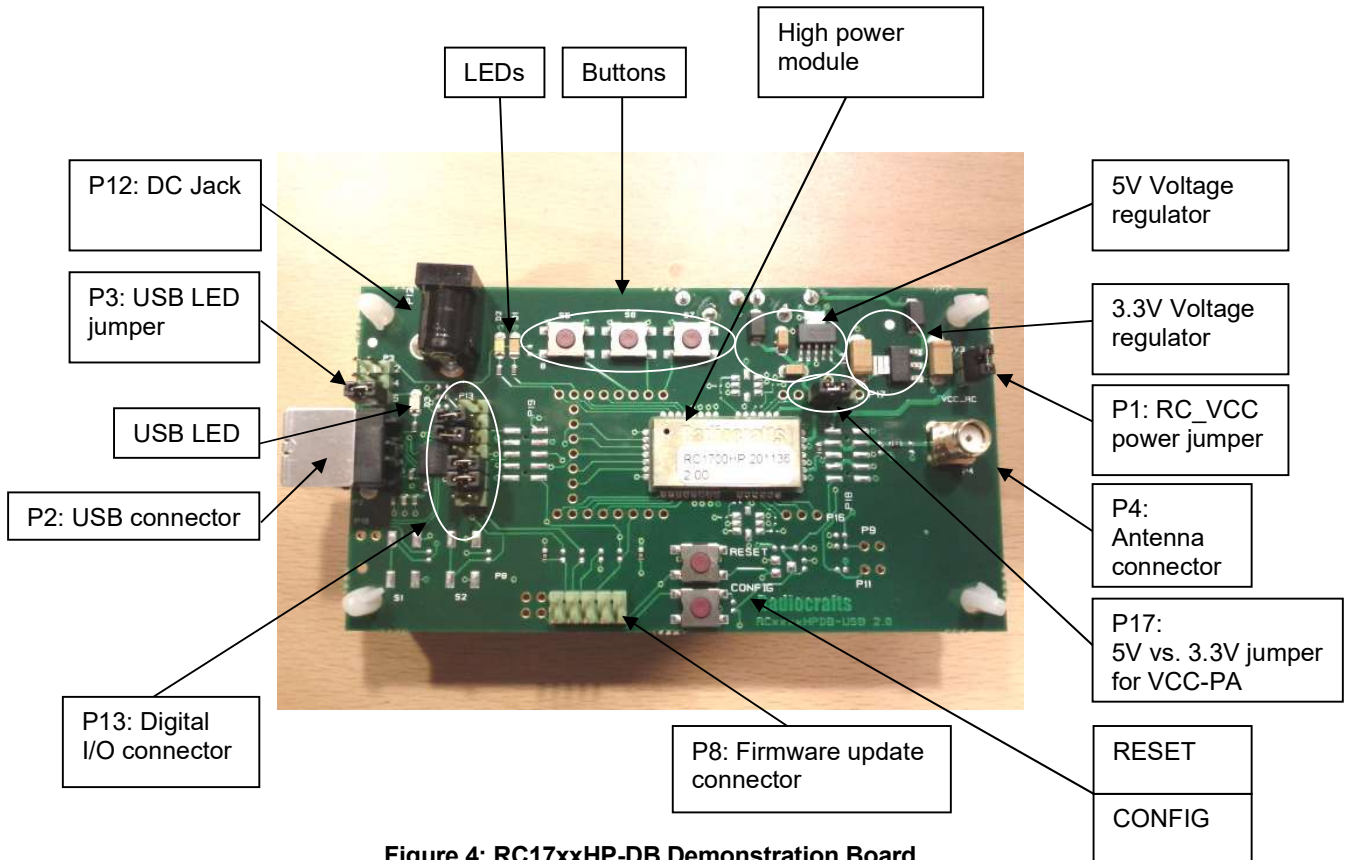


Figure 4: RC17xxHP-DB Demonstration Board

Block Diagram

The same PCB is used for all high power modules previously mentioned. The component assembly is however different depending on which module is mounted. The block diagrams in figure 5-7 informs about actual parts used for a given demo board.

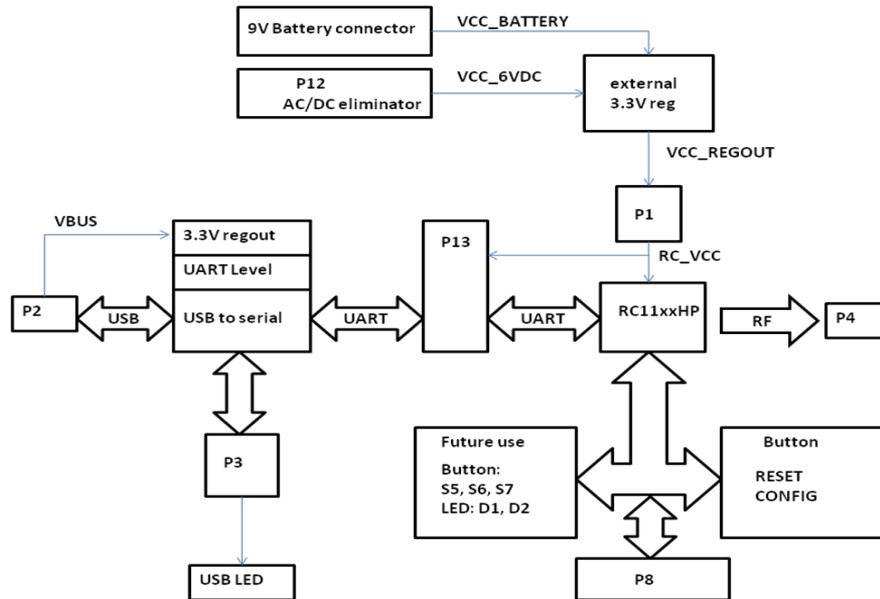


Figure 5: RC11xxHP-DB

LED D1 and LED D2 are activated on Demo Boards with TinyMesh protocol. See TinyMesh Data Sheet for details.

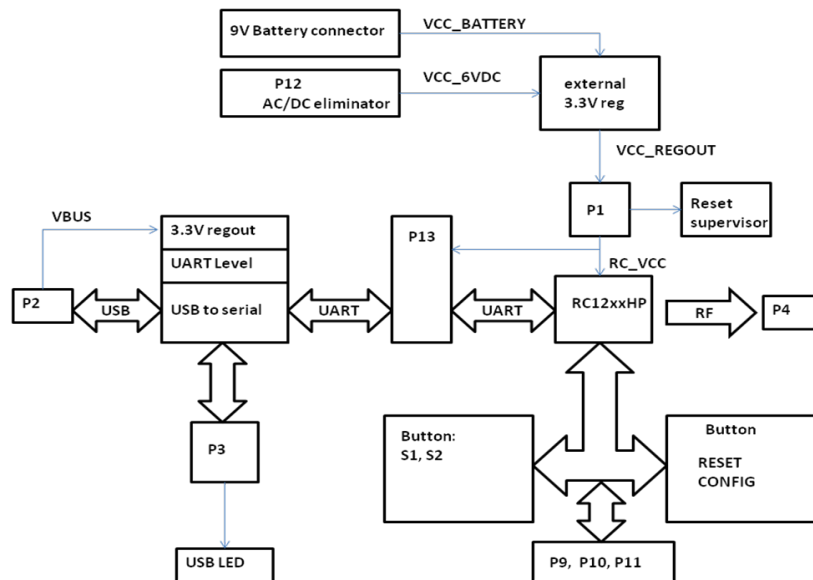


Figure 6: RC12xxHP-DB

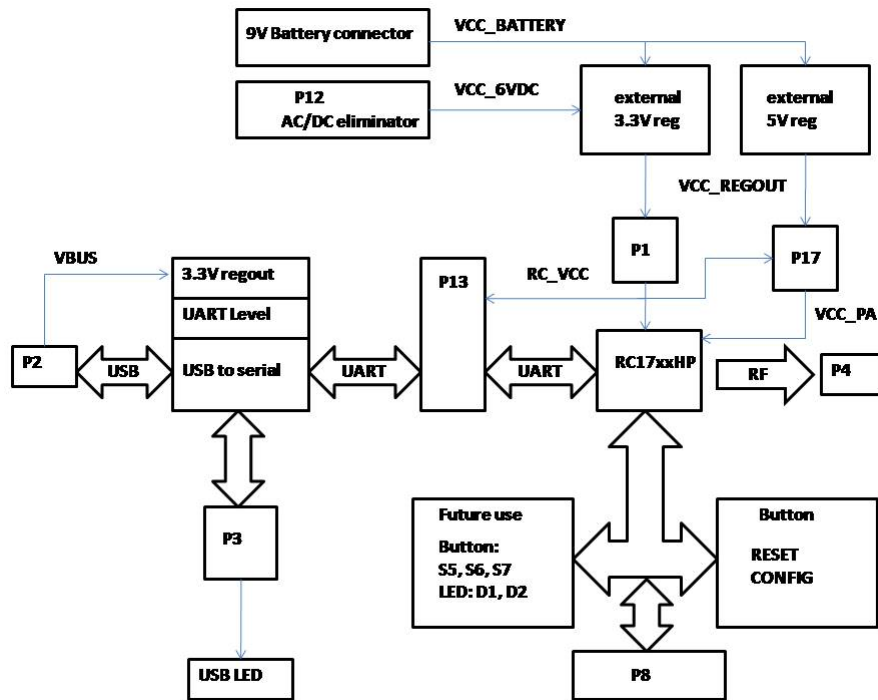


Figure 7: RC17xxHP-DB

Jumper section

The board contains several jumper options for connector P1, P3, P9, P10, P11 and P13. The connectors and jumper settings are summarized in this chapter.

| P1: UART voltage level jumper | | |
|-------------------------------|------------|--|
| Pin # | Signal | Note |
| 1 | VCC_REGOUT | 3.3V power from voltage regulator. |
| 2 | RC_VCC | Module Power. Connect jumper between pin 1 and pin 2 during normal IDLE, RX and TX operation. Replace jumper with Ampere meter for current consumption measurements. |

| P3: USB LED Jumper | | |
|---|--------|----------|
| Pin # | Signal | Note |
| 1 | 2 | TXD Data |
| 3 | 4 | RXD data |
| 5 | 6 | POWER |
| Install jumper to enable LED when Power is available from USB (default). LED current draw is typ 2.5 - 3.5 mA depending on RF module | | |

| P9: ON/OFF Jumper | | |
|-------------------|--------|--|
| Pin # | Signal | Note |
| 1 | ON/OFF | Add jumper to enter OFF mode for RC12xxHP-DB. Not in use for RC11xxHP-DB |
| 2 | GND | |

| P10: CTS Jumper | | |
|-----------------|--------|--|
| Pin # | Signal | Note |
| 1 | 2 | CTS |
| | | Remove jumper for enabling CTS for RC12xxHP-DB. Not in use for RC11xxHP-DB |

| P11: PA_EN Jumper | | |
|-------------------|--------|--|
| Pin # | Signal | Note |
| 1 | PA_EN | Add jumper to switch off high power PA for RC12xxHP-DB. Not in use for RC11xxHP-DB |
| 2 | GND | |

| P13: Digital I/O Connector | | |
|----------------------------|--------|--|
| Pin # | Signal | Note |
| 1 | 2 | VCC_REGOUT |
| | | 3.3V power from voltage regulator. Can be used to power external plug-in board. |
| 3 | 4 | CTS |
| | | Install jumper when using hardware handshake |
| 5 | 6 | RTS |
| | | Install jumper when using hardware handshake |
| 7 | 8 | CONFIG |
| | | 7 and 8 connected together. Connect pin 7 to pin 3 for PC control of CONFIG |
| 9 | 10 | TXD |
| | | Jumper installed from factory Remove jumper when measuring sleep mode current |
| 11 | 12 | RXD |
| | | Jumper installed from factory Remove jumper when measuring sleep mode current |
| 13 | 14 | GND |

| P17: VCC_PA Power Selection | | |
|-----------------------------|--------|--|
| Pin # | Signal | Note |
| 1 | 5V | 5V regulator output |
| 2 | VCC_PA | RC1700HP selection only. Jumper to select between 5V and 3.3V power for internal PA. |
| 3 | 3.3V | 3.3V regulator output. |

Prototyping with the RCxxxxHP-DB

All pins to the module are available through standard pin rows using a pitch distance of 100 mil (2.54 mm). This simplifies the build of a standalone application just by making a small plug-in-board to the existing Demo Board. Battery connectors on the bottom side are available for self powered demos, and REGOUT is available on P13. The Battery clips and most of the connectors are not mounted from factory, but part numbers are available from the Bill of Materials at the end of this document. The idea is that an external MCU and application specific sensors etc easily can be connected to the Demo Board as a proof of concept for the final product.

Antenna selection versus range performance

The choice of antenna is crucial for achieving the maximum range for any radio system. Due to the small size of the PCB and the off-centre placement of the onboard SMA connector the Demo Boards will not demonstrate the maximum range or omnidirectional radiation. To improve this, a larger groundplane and a centred placement of the antenna above this groundplane is required. One possible solution for maximum radiation is shown in the figure below. With the addition of two different SMA adaptors and one sufficiently large groundplane (radius $\geq L$, length of the antenna) and a good electrical connection to the GND-layer, an optimum performance of the antenna following the kit is achieved.

Other antenna solutions can be tested by connecting to the existing SMA female connector on the Demo Board via one of the methods below:

1. Solder the feeding point of the antenna to be tested directly to an SMA male connector and fasten to the SMA female connector
2. Connect to an external antenna (or board with antenna) via a shortest possible 50 Ohm coax cable with minimum insertion loss

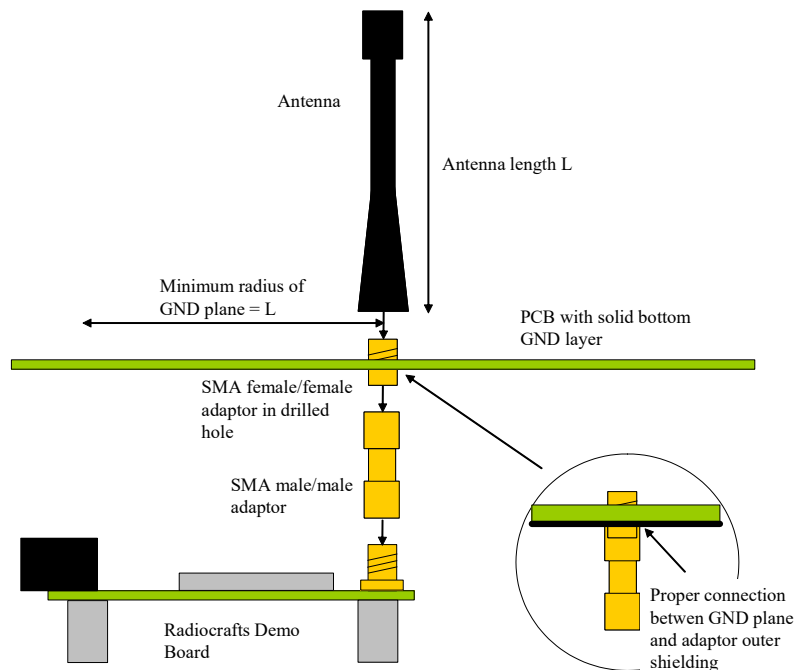


Figure 7: Extending size of ground plane with extra PCB

RCxxxxHP-DB Circuit Diagram, PCB and Assembly layout

A full resolution schematic is found in RCxxxxHPDB_x_x.zip available from Radiocrafts' webpage. To download follow this link to download your revision of the board:

https://www.radiocrafts.com/uploads/rcxxxxdbhp-usb_3_00.zip

Troubleshooting

It doesn't work. The Power LED is not lighting.

- Is the USB connector active? Some USB ports may be disabled if it's not commonly in use. The Demo board takes power from the USB port, and need an active USB port to power the board.
- Are all jumpers placed at the default position? P3 can disable POWER LED info, and P9 can disable power to the module.

I cannot communicate with the UART through the serial port

- Make sure that the RXD and TXD jumpers are inserted on P13.
- Set up your terminal program according to the instructions in the Quick Start Guide. Remember to select the correct COM-port and connect to this port.
- Entering configuration mode (by press CONFIG button) the command prompt (">") should be displayed on the terminal window. Make sure to exit the command mode using the exit command (capital "X").

I cannot communicate between two modules in buffered mode

- Make sure that the address mode and CRC mode is the same in both modules (set using the "M" Memory configuration command, refer to the RC232 User Manual).
- Make sure the destination address is the same as the other modules Unique ID addressing is used (set using the "T" Destination address command, refer to the RC232 User Manual).
- Make sure to exit from command mode using capital "X".
- The present configuration can be listed to the terminal using the test command "0" (zero).
- -SIG variants do not able to communicate with each other. For further details, please see the relevant User Manual.

The module consumes more than the rated current in OFF and SLEEP mode

- Note that the ON/OFF signal pull up resistor R2 (100 k Ω) draws approximately 27 uA. Remove this resistor when measuring the module current in OFF mode For RC12xxHPDB.
- Note that the level driver on the USB controller has common power as the module for default jumper setting. Remove P3 jumpers during the measurements.

I cannot access configuration mode when I press the CONFIG button

- Press and hold CONFIG button while pushing the RESET button (or power up the board). The reason you could not enter configuration mode, is most likely that some configuration memory values have been set to illegal values. List and check all values using the '0' (zero) command. Set all values back to default values (see RC232 User Manual or the respective Data Sheet).
- Note: If the mode is already in configuration mode it will not respond with another prompt if the CONFIG button is pressed. Send the '0' (zero) command to the module in order to check if it is already in configuration mode.

I get unexpected results when measuring supply voltage with V-command

- See *Known Issues* section

Known Issues

| HW Version | Issue |
|-----------------|--|
| 3.0 and earlier | The UART level from the FTDI-chip is always 3.3V. This work well when module is powered with 3.3 +/- 0.3V. Powering the module with external source <3.0V or >3.6V will create leakage current in UART input pins and give strange results for 'V' command, sleep current and so on. |

Document Revision History

| Document Revision | Changes |
|-------------------|--|
| 1.0 | First release |
| 1.1 | Updated with RC1700HP info |
| 1.11 | Updated with TinyMesh info (-TM) |
| 3.01 | Updated with SIGFOX info, |
| 3.02 | Updated link to schematics Added chapter "Known Issues" |

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