

RC24xx-ZNM-DK-USB Demonstration Kit User Manual

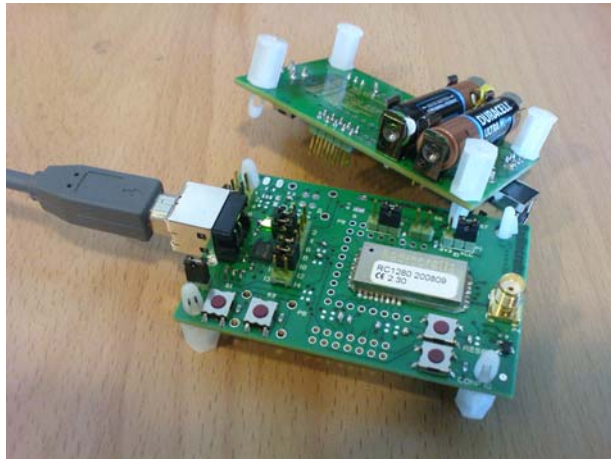


Table of contents

TABLE OF CONTENTS	1
DEMONSTRATION KIT INTRODUCTION	2
DEMO BOARD INTRODUCTION	3
BLOCK DIAGRAM.....	5
JUMPER SECTION.....	6
PROTOTYPING WITH THE RCXXXXDB-USB	8
ANTENNA SELECTION VERSUS RANGE PERFORMANCE	8
RCXXXXDB-USB CIRCUIT DIAGRAM.....	9
RCXXXXDB-USB PCB AND ASSEMBLY LAYOUT	9
RCXXXXDB-USB BILL OF MATERIALS.....	10
TROUBLESHOOTING	11
DOCUMENT REVISION HISTORY.....	12
DISCLAIMER	12
TRADEMARKS	12
LIFE SUPPORT POLICY	12
CONTACT INFORMATION.....	12

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 three Demo Boards (DB). 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/radio module	3
Antenna, 50Ω quarter-wave monopole, SMA male connector	3
USB Cable	3
CC-debugger	1

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.

Related document also required to use the kit

- RC2400/RC2400HP-ZMN-DK-USB Quick Start
- ZNM-CCT User Manual
- RC2400/RC2400HP-ZNM User Manual

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 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 Demonstration Board comes in different versions, equipped with the different variants of Radiocrafts modules. Among the frequencies supported are 433 MHz, 868 MHz, 915 MHz and 2.45 GHz. For each frequency there exist narrowband versions and wideband versions. This covers the most used frequency bands, the 433 MHz band in Europe and the US, the 868 MHz band in Europe, the 902-928 MHz band in the US and the 2.45 GHz band worldwide. The actual module mounted can be seen on the marking on the module itself.

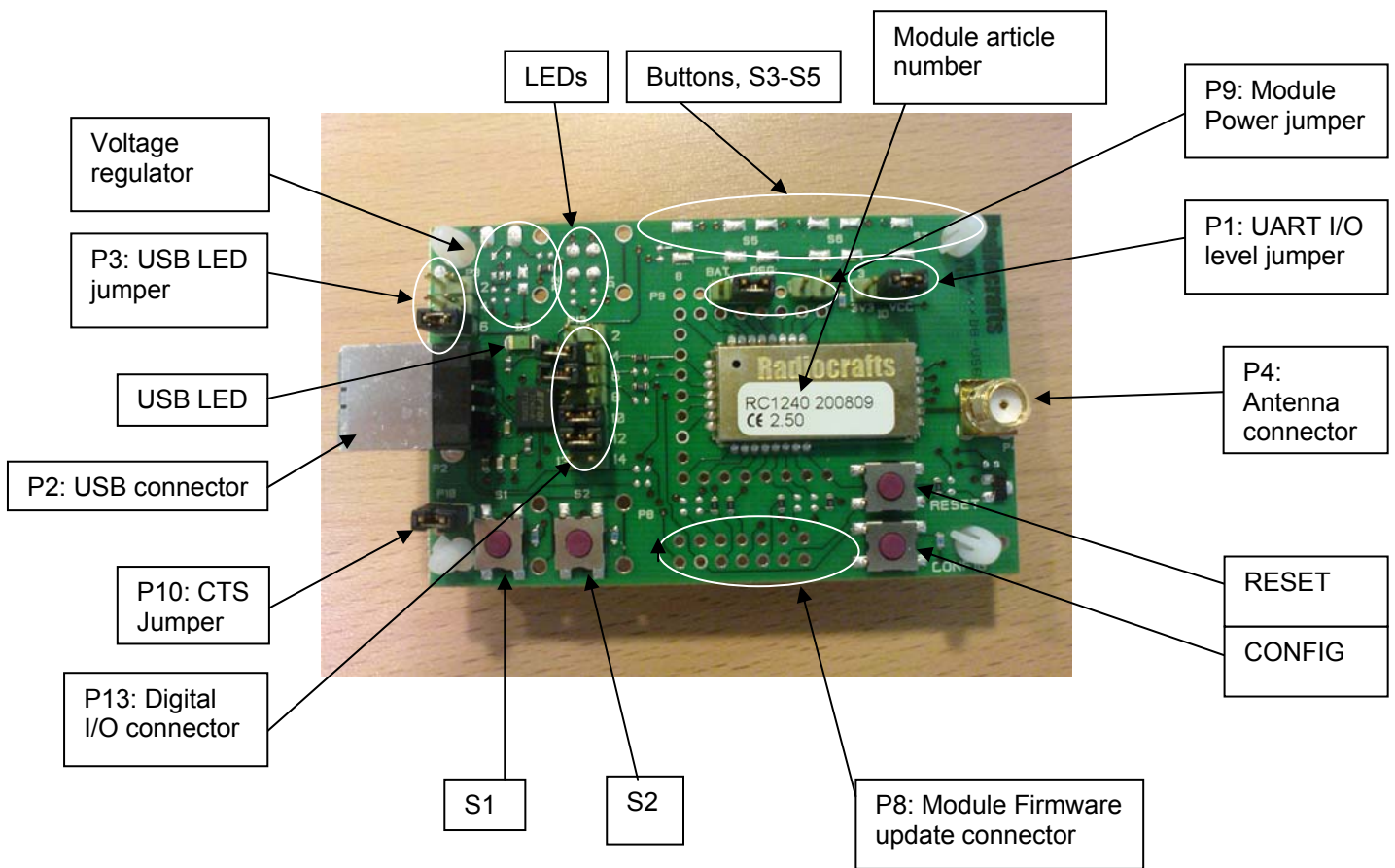


Figure 1: RCxxxxDB-USB Demonstration Board

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 RCxxxxDB 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. The UART is connected to the P0 UART on RC2400. With the embedded ZNM firmware the ZNM-CCT tool can be used to configure module and send/receive ZigBee messages.

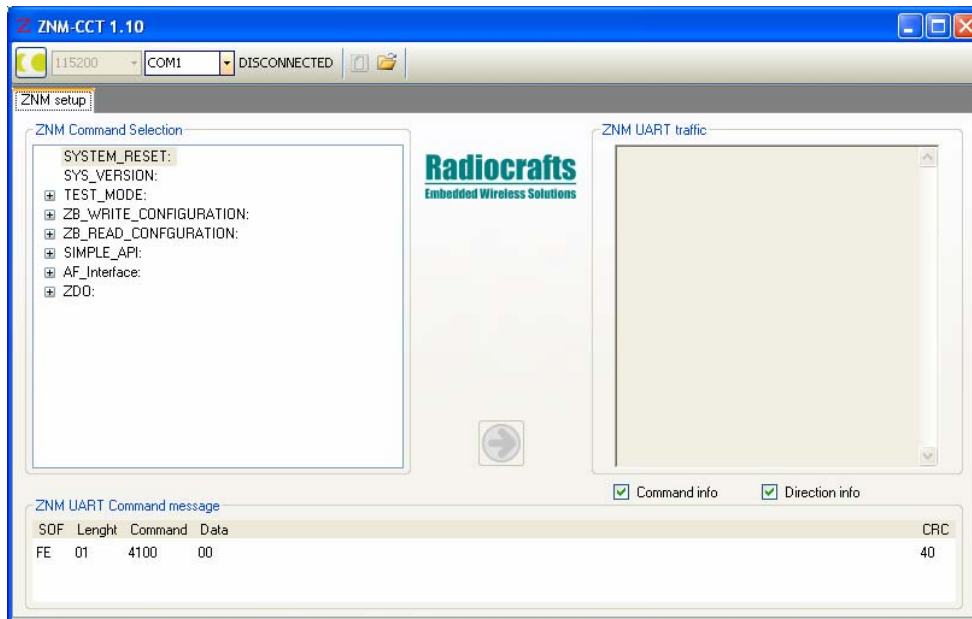


Figure 2: ZNM-CCT, one of the applications in RCTools

Block Diagram

The block diagrams in figure 3 informs about actual parts used for a given demo board.

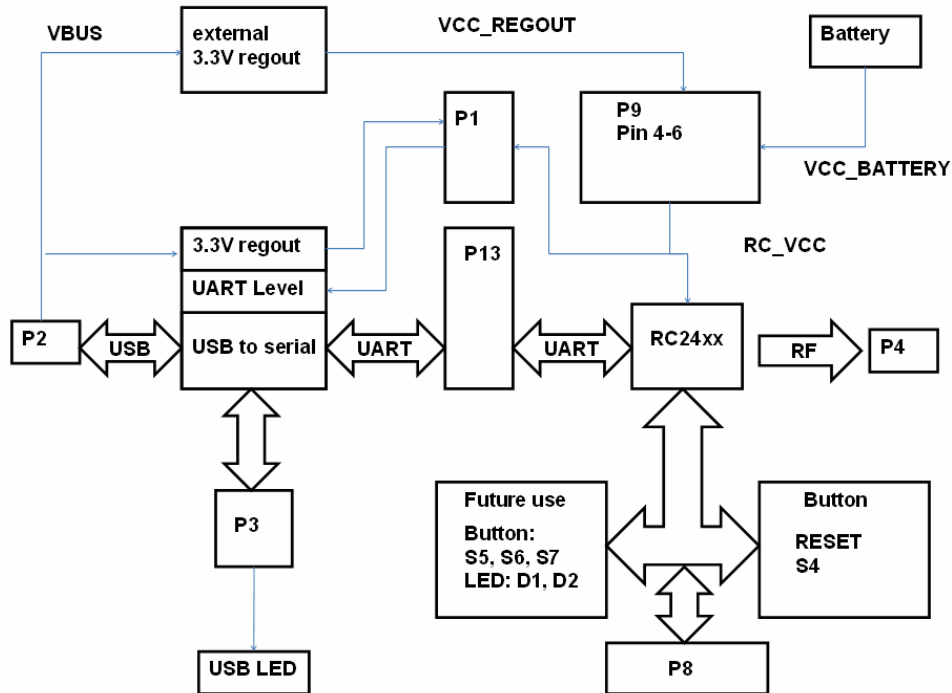


Figure 3 RC24xxDB-USB

Jumper section

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

P1: UART voltage level jumper		
Pin #	Signal	Note
1	RC_VCC	Module Power. Connect to pin 2 during default.
2	VCCIO_FT232	Sets the UART voltage level for the USB chip and provide power to the USB LED. Must not exceed more than RC_VCC+0.3V. Remove jumper when measuring SLEEP and OFF current in order not to include leakage current from the USB chip UART.
3	3V3	3.3V regulator output from USB chip. Connect to pin 2 when measuring current consumption in RX and TX mode.

P3: USB LED Jumper			
Pin #		Signal	Note
1	2	TXD Data	Install jumper to enable LED blink when data on UART RXD. RF transmit mode
3	4	RXD data	Install jumper to enable LED blink when data on UART TXD. RF receive mode
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: Module Power jumper		
Pin #	Signal	Note
1	GND	
2	RCxxxx pin12	RC11xx/RC2xxxDB-USB: RESET (not in use) RC12xxDB-USB: ON/OFF. Connect to pin 1 to measure OFF current drain. Note that The 100k pull-up resistor R2 will draw approximately 27 uA in OFF mode if not removed. The pull-up resistor is used to keep the module in ON mode for normal use. In a real application this pin could be controlled by a digital output, and (the pull-up) R2 could be omitted, and hence the very low OFF mode current consumption can be achieved
3	RCxxxx pin11	RC11xx/RC2xxxDB-USB: not in use RC12xxDB-USB: VDD (internal regulator out from the module)
4	VCC_REGOUT	RC11xxDB-USB: Power from external regulator (3.0V) RC2xxxDB-USB: Power from external regulator (3.3V) RC12xxDB-USB: USB chip regulator (3.3V)
5	RC_VCC	Power to the module. An ampere meter can be connected in order to measure the DC current drawn by the module. External power can also be connected to this pin. Ensure that the same level is connected to P1 pin 2.
6	RC_BATTERY	Power from battery on the bottom side
7	VCC_REGIN	Input to external regulator
8	VBUS	Power from USB port

As described in the table above, the RC11xx/RC2xxxDB-USB series has a different component assembly compared to the RC12xxDB-USB for P9. Connector and default jumper settings are illustrated below for the two different assemblies.

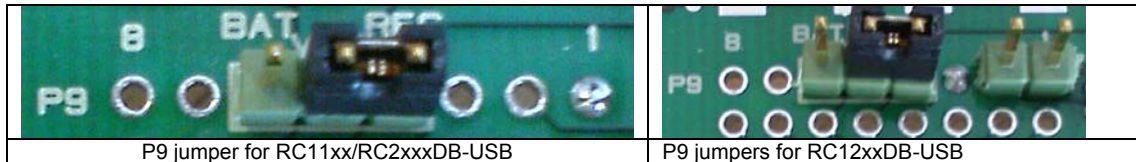


Figure 4: RCxxxxDB-USB P9 assembly and default jumper settings

P10: CTS			
Pin #		Signal	Note
1	2	CTS	Remove jumper for enabling CTS for RC12xxDB-USB. Not in use for RC11xx/RC2xxxDB-USB

P13: Digital I/O Connector			
Pin #		Signal	Note
1	2	GND	RC11xx/RC2xxxDB-USB: Connect jumper between 2 and 4 to enter sleep mode
3	4	RTS	Install jumper when using hardware handshake
5	6	CTS	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 RC11xx/RC2xxxDB-USB: Remove jumper when measuring sleep mode current
11	12	RXD	Jumper installed from factory RC11xx/RC2xxxDB-USB: Remove jumper when measuring sleep mode current
13	14	GND	

Prototyping with the RCxxxxDB-USB

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 there is also access to VBUS (+5V), REGIN and REGOUT on P9. 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

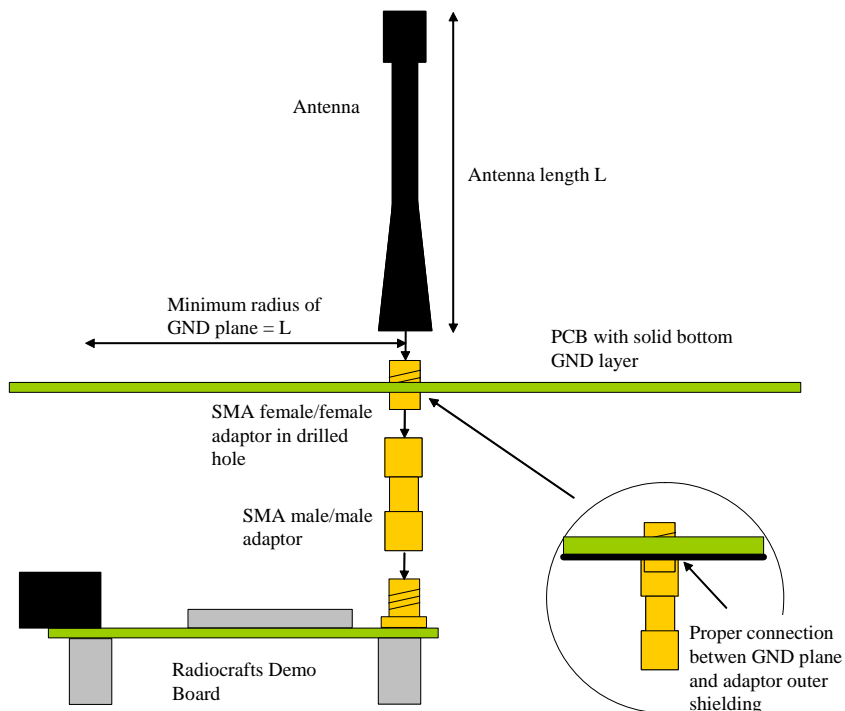


Figure 5: Extending size of ground plane with extra PCB

RCxxxxDB-USB Circuit Diagram

The circuit diagram of RCxxxxDB-USB is in figure 8. A full resolution schematic is found in RCxxxxDB_x_x.zip available from Radiocrafts' webpage.

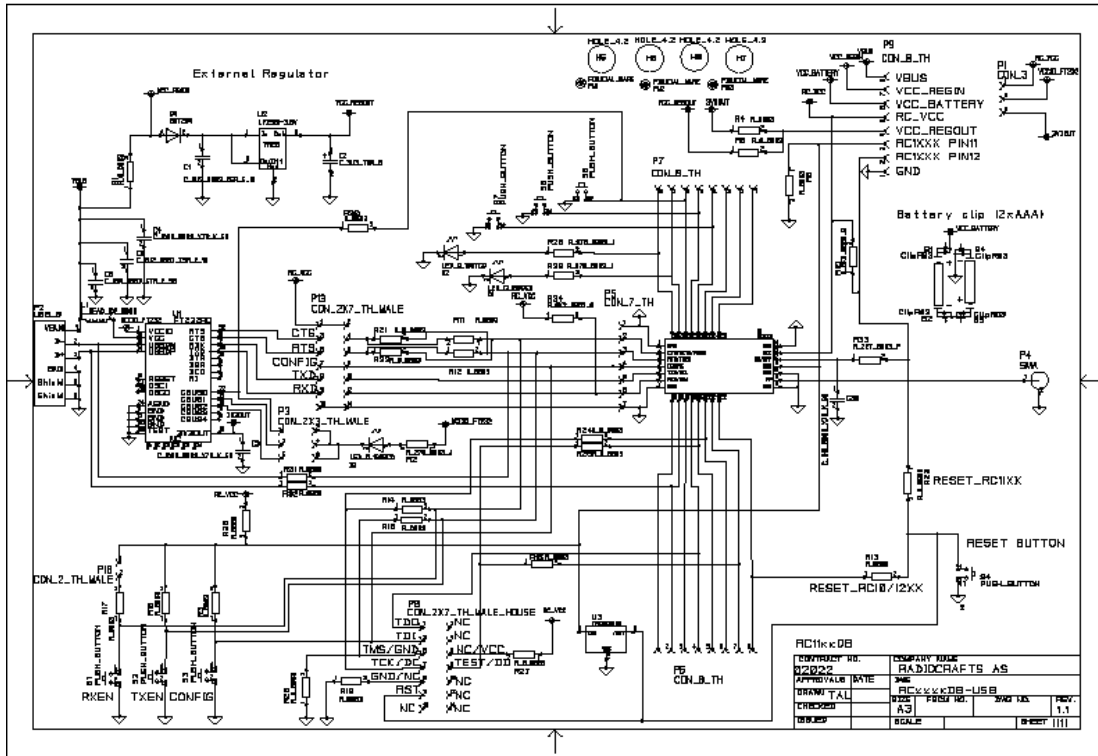


Figure 6: RCxxxxDB-USB Circuit diagram

RCxxxxDB-USB PCB and Assembly layout

The PCB is a simple 4-layer board where Layer 2 is used as ground plane. The laminate used is standard FR-4 board material. The PCB is 1.6mm thick. Full resolution layout and assembly drawing are found in RCxxxxDB-USB_x_x.zip.

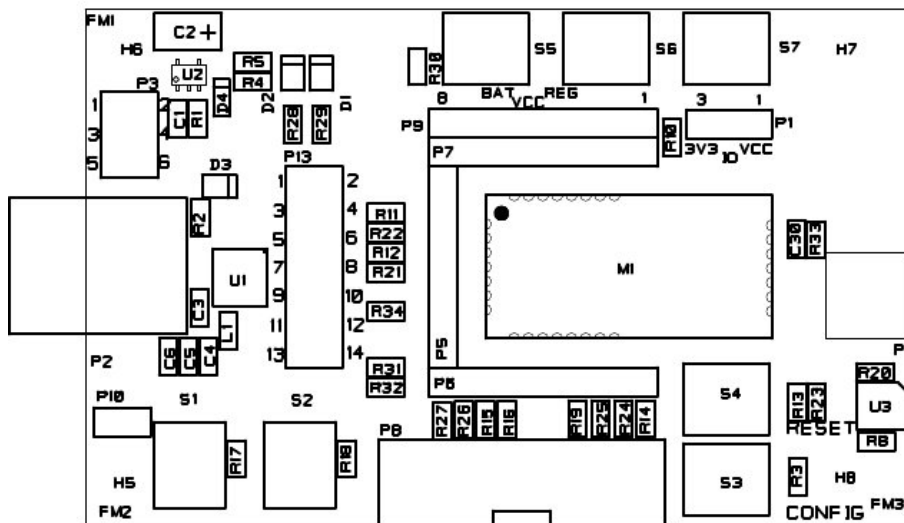


Figure 7: RCxxxxDB-USB PCB component placement, top side

RCxxxxDB-USB Bill of materials

The circuit diagram includes all components of RCxxxxDB-USB, but all three versions of the Demo Boards has different component bill of materials. Details are listed in the following tables. Components not mounted are marked *DNM (Do Not Mount)* in the 'Quantity' column.

RCxxxxDB-USB Bill of materials for RC24xx-ZNM-DB-USB			
Reference	Quantity	Part number	Description
D4	1	BAT254	Diode, Si
P3	1	CON_2X3_TH_MALE	Connector 6 pins, pin header
P13	1	CON_2X7_TH_MALE	Connector 14 pins, pin header
P8	1	CON_2X5_TH_MALE	Connector 10 pins
P10	1(DNM)	CON_2_TH_MALE	Connector, 0.9 mm pin, male
P1; P9	2	CON_3	Connector, 0.9 mm pin
P5	1(DNM)	CON_7_TH	Connector, 0.9 mm pin
P6-7;	2(DNM)	CON_8_TH	Connector, 0.9 mm pin
C3-4	2	C_100N_0603_X7R_K_50	Capacitor, 0603
C5	1	C_10N_0603_X7R_K_50	Capacitor, 0603
C1;C6	2	C_2U2_0603_X5R_K_10	Capacitor, 0603
C2	1	C_3U3_TAN_B	Capacitor, tantalum
B1-4	4(DNM)	ClipR03	Battery ClipR03 (AAA)
FM1-3	3(DNM)	FIDUCIAL_MARK	Fiducial mark
U1	1	FT232RQ	USB UART IC
H5-8	4	HOLE_4.2	PCB feet
D1	1	LED_CL150DCD	LED, orange, SMD
D3	1	LED_CL150GCD	LED, green, SMD
D2	1	LED_CL150YCD	LED, yellow, SMD
U2	1	LP2992-3.3V	3.3V low drop-out regulator. 250 mA
L1	1	L_BEAD_102_0603	EMI filter bead
S1-2	2(DNM)	PUSH_BUTTON	Push button, SMD
S3-7	5	PUSH_BUTTON	Push button, SMD
M1	1	RC24XX-ZNM	RF Module
R4; R13-R22; R30-32	14(DNM)	R_0603	Resistor, 0603, general
R1; R5; R11;R12; R23-27;	9	R_0_0603	Resistor, 0603
R3; R10	2(DNM)	R_100K_0603_G	Resistor, 0603
R2;R28-29	3	R_270_0603_J	Resistor, 0603
P4	1	SMA	SMA connector
U3	1(DNM)	TPS3809J25	Voltage supervisor, 2.5V, SOT-23
P2	1	USB_B	USB B-style connector

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.
- Is the module powered correctly? Measure the supply voltage at P9, pin 5. Should be 3.0V for RC11xxDB-USB and 3.3V for RC12xxDB-USB and RC2xxxDB-USB

I cannot communicate with the UART through the serial port

- Make sure that the RXD, TXD, RTS and CTS 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.

Document Revision History

Document Revision	Changes
1.0	First release for RC2400/RC2400HP

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