

***CC1110DK
CC2430DK
CC2510DK
Development Kit***

***User Manual
Rev. 1.7***

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1 Introduction

Thank you for purchasing a SmartRF®04DK Development Kit.

Please note that Texas Instruments uses the term SmartRF®04DK as a collective term for all development kits on the Chipcon SmartRF®04 platform. This development platform supports evaluation, development and prototyping using the Chipcon SmartRF®04 products from Texas Instruments.

Make sure to subscribe to the Low-Power RF eNewsletter to receive information about updates to documentation, new product releases and more. Sign up on the Texas Instruments RF/IF Components web site.

2 About this manual

This manual contains both tutorial and reference information, and covers both the hardware and software components of the development kit.

Further background information can be found in the SmartRF® Studio User Manual and the device datasheets.

3 Definitions

SmartRF04EB	Evaluation Board. Main board with LCD, USB interface, LEDs, pot-meter etc. Platform for the Evaluation Modules (EM, see below).
SmartRF®04DK	A collective term used for all development kits for the SmartRF®04 platform, i.e. SmartRF04EB + EM.
CC2430EM	CC2430 Evaluation Module, a small plug-in module for SmartRF04DK, should be used as reference design for RF layout.
CC2510EM	CC2510 Evaluation Module, a small plug-in module for SmartRF04DK, should be used as reference design for RF layout.
CC1110EM	CC1110 Evaluation Module, a small plug-in module for SmartRF04DK, should be used as reference design for RF layout.
USB MCU	The Silicon Labs C8051F320 MCU used to provide a USB interface on the SmartRF04DK.
Factory firmware	The firmware that is supplied programmed into the USB MCU from the factory. This firmware supports SmartRF® Studio operation as well as a stand-alone PER tester.
PER	Packet Error Rate. Counts the number of lost and/or faulty packets and displays the ratio: (lost/faulty packets)/number of packets sent.
SoC	System on a Chip. A collective term used to refer to Texas Instruments ICs with on-chip MCU and RF transceiver. Used in this document to reference the CC2430 and the CC2510.
ICE	In Circuit Emulator.

4 Kit content

4.1 Hardware

The development kit contains the following:

- 2 x SmartRF04EB
- 2 x evaluation modules (CC2430EM, CC1110EM¹ or CC2510EM)
- 2 x 2.4GHz Antennas
- 2 x USB cables
- 1 x 10-wire flat cable for using SmartRF04EB as emulator for external target systems
- Quick start guide



SmartRF04EB with CC2430EM

The SmartRF04DK Development Kit includes a number of functions and applications that allows quick testing of the RF interface and peripherals of the chip.

- Evaluate the SmartRF[®]04 products. Right out of the box, the kit can be used for range testing.
- Use SmartRF[®] Studio to perform RF measurements. The radio can be easily configured to measure sensitivity, output power and other RF parameters.
- Prototype development. The SmartRF04DK includes a USB interface that can be used as emulator interface for the CC1110/CC2430/CC2510. All I/O ports are available on pin connectors on the edge of the board to allow easy access for external applications. These connectors are also compatible with logic analyser probes for easy debugging.

¹ The CC1110DK development kit is temporarily changed. Please see the Product Information section on the CC1110-xxx MHz Development Kit web page for details

5 SmartRF04EB

This chapter includes overall information that applies to SmartRF04EB. In the following SoC means Chipcon System on Chip, i.e. CC1100, CC2510, or CC2430.

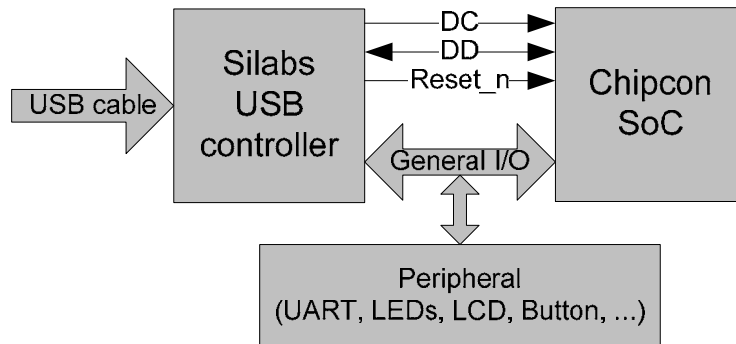


Figure 1: Main components

Figure 1 shows the main components on the SmartRF04EB. A USB cable from a PC is connected directly to the Silabs USB controller. When a SoC evaluation module is pulged into the SmartRF04EB, the only purpose of the USB controller is to “translate” USB signals to the SoC 2-wire debug interface. This interface includes Debug Clock (DC) and Debug Data (DD). The USB controller also controls the reset_n line connected to the SoC.

Most of the peripherals on the SmartRF04EB are connected to both the Silabs USB controller and to the SoC. This means that I/O ports on both controllers can drive the same pin. When the Silabs controller detects that a SoC is connected, it will therefore set all the I/O in three-state (high impedance) mode. The connection to the Silabs USB controller may anyhow somewhat influence these I/O lines.

5.1 Silabs USB MCU

5.1.1 Bootloader

The Silabs USB controller is programmed with a bootloader when it is shipped from the factory. The bootloader allows programming of new code into the USB MCU without the Silicon Labs’ serial adapter. The bootloader communicates with SmartRF® Studio or a custom program via USB.

5.1.2 Programming Silabs USB controller

If it is required to update the firmware of the USB MCU, this can be done using the SmartRF04 programming software (Chipcon Flash Programmer or SmartRF Studio). For use of Chipcon Flash Programmer please refer to Chipcon Flash Programmer user manual for instructions. The Silabs controller can only be updated via USB when no EM is connected to the SmartRF04EB.

To download firmware to the Silabs USB MCU without using the bootloader or to download the bootloader in the first place, a Silicon Labs’ EC2 serial adapter (Figure 2) is required. This adapter should be connected to P301, marked “USB MCU debug”, on the SmartRF04EB.



Figure 2: EC2 serial adapter

5.2 USB MCU signal names

The USB MCU is a C8051F320 from Silicon Labs. Please see the Silicon Labs web site for detailed information about this MCU.

The following table shows the usage of I/O pins on the USB MCU.

Pin no.	Pin name (USB MCU)	Signal name SmartRF04EB	0-ohm resistor	Function
1	P0.1	P1.7/SO/GDO1/MISO	R117	SPI MISO signal, transceiver/transmitter SO/GDO2
2	P0.0	P1.5/SCLK	R115	SPI Serial clock
10	P3.0/C2D			USB MCU Debug pin
11	P2.7	P1.3/LED3	R113	LED3 (yellow), active low
12	P2.6	P0.4/RTS	R100	
13	P2.5	RS232_POWER		Turns RS-232 level converter on/off
14	P2.4	P2.0/LED_4	R120	LED4 (Blue), active low
15	P2.3	RESET_N		LCD Power on reset signal, SoC RESET
16	P2.2	SOC_PRESENT		Tells USB MCU whether a SoC is present. 0 = transmitter/transceiver 1 = SoC
17	P2.1	P0.6/JOY	R106	Joystick input (analogue coded voltage)
18	P2.0	P1.2/LED2	R111	LED2 (Red), active low
19	P1.7	P1.0/LED1	R110	LED1, (Green), active low
20	P1.6	P0.7/POT	R107	Potentiometer input
21	P1.5	P0.5/JOY_PUSH	R112	Joystick pushed
22	P1.4	P1.1/PWM_OUTPUT	R105	PWM audio output
23	P1.3	P0.1/BUTTON_PUSH	R101	Button pushed
24	P1.2	P0.0/MIC_INPUT	R104	Audio input
25	P1.1	P2.4/SCL	R124	I2S clock (for LCD)
26	P1.0	P2.3/SDA	R123	I2S data (for LCD)
27	P0.7	P2.2/GDO2/DC	R122	Transceiver/transmitter GDO3, SoC debug signal
28	P0.6/CNVSTR	P2.1/GDO1/DD	R121	Transceiver/transmitter GDO1, SoC debug signal
29	P0.5	P0.2/UART_RD	R102	UART RD
30	P0.4	P0.3/UART_TD	R103	UART TD
31	P0.3/XTAL2	P1.4/CSn/SS	R114	SPI slave select signal
32	P0.2/XTAL1	P1.6/MOSI	R116	SPI MOSI signal, Transceiver/Transmitter SI

Table 1: USB MCU pin-out

As mentioned in the table, the joystick output is coded as an analogue voltage. This has been done in order to save the number of pins required on the MCU to interface with the joystick. The SoC software libraries contain functions to decode the ADC values and indicate in what direction the joystick is moved. The push function of the joystick is treated as a separate digital signal.

6 Hardware description SmartRF04EB

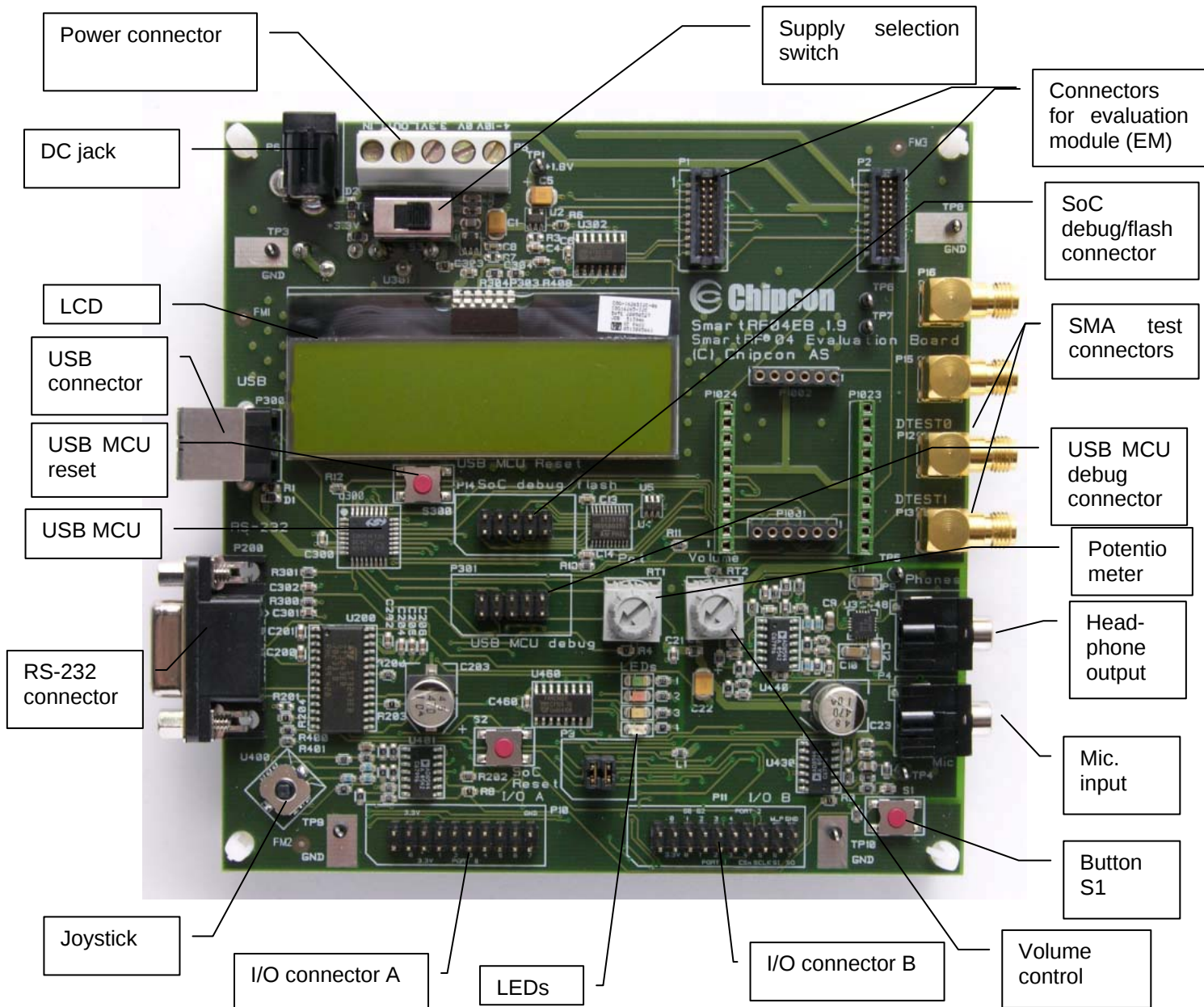


Figure 3: SmartRF04DK overview

The figure above shows the major parts of the SmartRF04EB. The SmartRF04EB serves as main platform in the development kit.

6.1 Powering SmartRF04EB

If several power sources are connected to SmartRF04EB the board will be powered from the supply that supplies the highest voltage.



Figure 4: Power switch setting

The Power Switch S3 must be set according to what power source is used. If 3.3V is applied using the power terminal block, the switch should be set to the left position. In all other cases, the switch should be set to the right position for power to be applied to the SmartRF04EB. This switch can be used to turn off the SmartRF04EB by switching it to the opposite position of that used to turn it on.

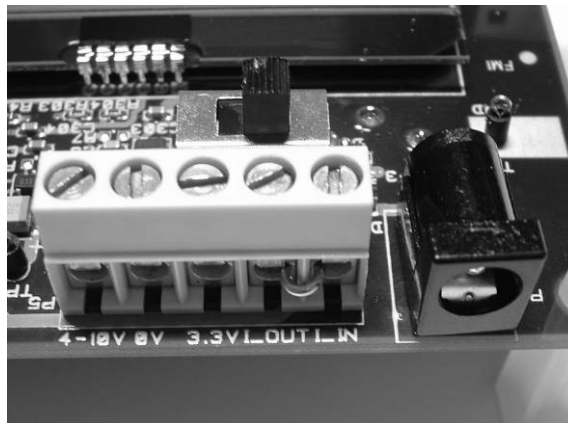


Figure 5: Power connector

The 4-10V input is used for powering the SmartRF04EB using the on-board voltage regulator. 0V is the ground connection. The 3.3V terminal is used for powering the SmartRF04EB, bypassing the on-board voltage regulator. A voltage between 2.7 and 3.6V can be used when USB is not active, when using USB the voltage should be limited to 3.0-3.6V.

The SmartRF04EB can be powered in several different ways:

- **DC jack** connector with standard DC jack power connectors with a 2.5mm centre pin. The centre pin is used for the positive voltage. A 4-10V DC power supply should be used. The onboard voltage regulator supplies 3.3V to the board.
- **Laboratory power supply.** Ground should be connected to the 0V terminal on the power connector (see Figure 5). A 4-10V supply can be connected to the "4-10V" terminal, or a 3.3V supply can be connected to the "3.3V" terminal (the on-board voltage regulators will be bypassed in this case). If a 3.3V supply is used, the supply selection switch should be set to the "3V" position, otherwise the "4-10V" position should be used. If the "4-10V" position is selected, a voltage regulator supplies the circuitry on the SmartRF04EB; otherwise the 3.3V supply is applied directly to the SmartRF04EB.
- **USB power.** If the SmartRF04EB is connected to a USB socket on a PC, it will draw power from the USB bus. The onboard voltage regulator supplies 3.3V to the board.
- **Battery power.** The evaluation board includes a 9V-type battery connector on the bottom side of the PCB. A 9V battery or a battery pack that uses a 9V-type connector can be

connected to this battery connector. The onboard voltage regulator supplies 3.3V to the board.

Please note that while the SmartRF04 devices have a wide supply range, the components on the SmartRF04EB limit the total voltage supply range to 2.7V – 3.6V (3.0V – 3.6V while the USB is active). The SmartRF04EB has been designed for a temperature range of –40°C to +85°C (excluding the LCD display). The EM is designed for a temperature range of –40°C to +85°C.

6.2 USB Interface

The USB interface is used to interface to a PC to run SmartRF® Studio and for programming and debugging using the PC debugging tools and programmers. If SmartRF® Studio connects to the SmartRF04EB and detects an old version of the USB MCU firmware, the USB MCU will be upgraded via this interface. The SmartRF04EB can be bus-powered from the USB interface.

6.3 RS-232 interface

The RS-232 can be used by custom applications for communication with other devices. The RS-232 interface utilises a voltage translation device so that the RS-232 port is compatible with bipolar RS-232 levels.

Note that this RS-232 level converter contains a charge-pump power supply that generates electric noise.

6.4 User interface

The SmartRF04EB includes a joystick and a push button as user input devices, and four LEDs and a 2x16 character LCD display as user output devices. The display and user interface is by default controlled by the factory firmware in the SoC.

6.5 Audio interface

The SmartRF04EB includes a microphone input and headphone output.

The audio output section consists of a volume control, followed by a 4th order Chebychev filter. This filter serves to attenuate frequencies above 6 kHz, and so converts the PWM signal to an analogue audio signal. A headphone amplifier IC (TPA4411 from Texas Instruments) is used to drive the headphones.

Note that the headphone amplifier IC uses switch-mode power supply techniques to generate negative voltages, and this may cause electrical noise. The headphone amplifier can be disabled by driving a pin on the USB MCU low (the same pin is used to disable the RS-232 voltage converter).

The audio input section consists of a microphone amplifier that also includes a low-pass anti-aliasing filter.

A standard PC-type headset with separate microphone and headphone mini-jacks can be connected directly to the audio interface.

6.6 SPI interface swap jumpers on SmartRF04EB

Due to a bug in early revisions of some of the SoC's, the MISO and MOSI pins changed directions when switching between SPI slave and master modes. For newer revisions of the chip, the SPI jumper should always be in master mode position. The default settings of the jumpers are SPI master mode, see Figure 6. SPI slave mode is used by the Chipcon packet sniffer.

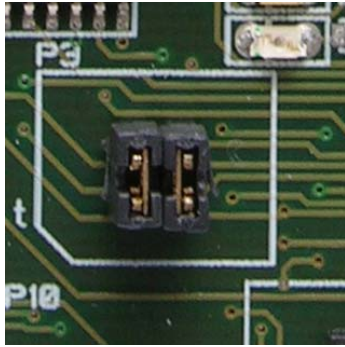


Figure 6: SPI jumper, Master mode

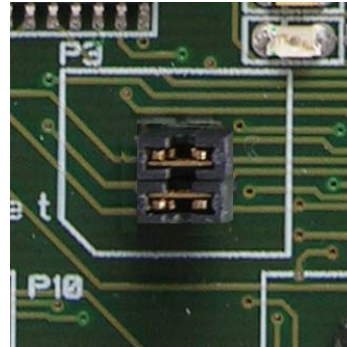


Figure 7: SPI jumper, Slave Mode

6.7 I/O connectors

The I/O connectors bring out all the signals from the EM connectors. These connectors are compatible with Agilent logic analyser probes. The connectors allow easy access to I/O signals and to connect prototyping boards.

Pin	Function
1	N/C
2	N/C
3	P0_0/MIC_IN
4	VDD
5	VDD
6	N/C
7	P0_1/BUTTON_PUSH
8	N/C
9	P0_2/UART_RD
10	N/C
11	P0_3/UART_TD
12	N/C
13	P0_4/RTS
14	N/C
15	P0_5/JOY_PUSH
16	N/C
17	P0_6/JOY
18	N/C
19	P0_7/POT
20	GND

Table 2: I/O connector A (P10) pin-out

Pin	Function
1	N/C
2	N/C
3	VDD
4	P2_0*/LED4
5	P1_0/LED1
6	P2_1/DD
7	P1_1/PWM_OUTPUT
8	P2_2/DC
9	P1_2*/LED2
10	P2_3/SDA
11	P1_3/LED3
12	P2_4/SCL
13	P1_4/CSn
14	N/C
15	P1_5/SCLK
16	RESET_N
17	P1_6/MOSI
18	Debug Data Direction(DD_DIR)
19	P1_7/MISO
20	GND

Table 3: I/O connector B (P11) pin-out,
* see chapter 6.10.

6.8 EM connectors

The EM connectors are used for connecting the EM to the SmartRF04EB. The connectors P1 and P2 are used as the main interface.

The EM should be used as an RF reference design with the Chipcon SoC, decoupling, and all required RF circuitry. It is recommended to copy this reference design when designing applications with Chipcon RF devices in order to achieve best RF performance.

Note that while it is physically possible to plug an EM not belonging to the SmartRF[®]04 product range into the SmartRF04EB, the factory firmware and SmartRF[®] Studio do not support the use of older devices. The SmartRF04EB can be used with custom firmware for prototyping using older Chipcon RF devices.

6.9 Signal flow

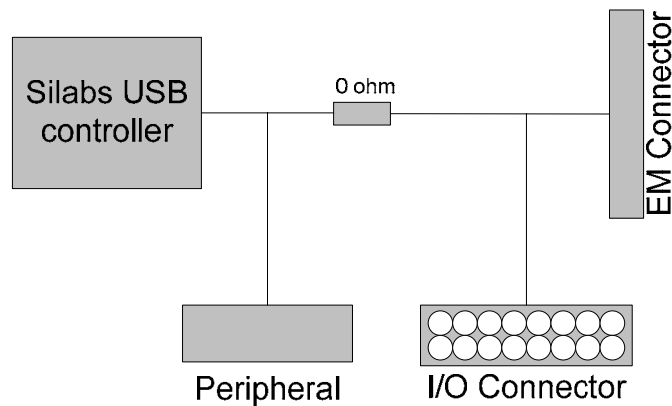


Figure 8: Evaluation Board Signal flow

The signal lines from the EM connectors run via 0-ohm resistors to the USB MCU and the various peripherals on the SmartRF04EB. This allows connecting an EM module to other applications. The USB MCU can be disconnected from the signal pins by removing the 0-ohm resistors. The I/O connectors are located on the "outside" of the 0-ohm resistors, so they are still connected to the EM connectors even if the 0-ohm resistors are removed. Please refer to Table 1 on page 6 for a list of 0-ohm resistors and corresponding signals.

The SmartRF04EB may not work with In-Circuit Emulator (ICE), SmartRF[®] Studio or the SW examples when the 0-ohm resistors are removed.

6.10 EM LCD connection

I/O pins P2_3 and 2_4 on the SoC are connected to a 32 kHz X-oscillator on the EM board. The LCD display is therefore internally, on the EM, swapped from P1_2 to P2_3 and P2_0 to P2_4 as shown in Figure 9. The figure shows the CC2430EM, but this also applies to both the CC1110EM and the CC2510EM.

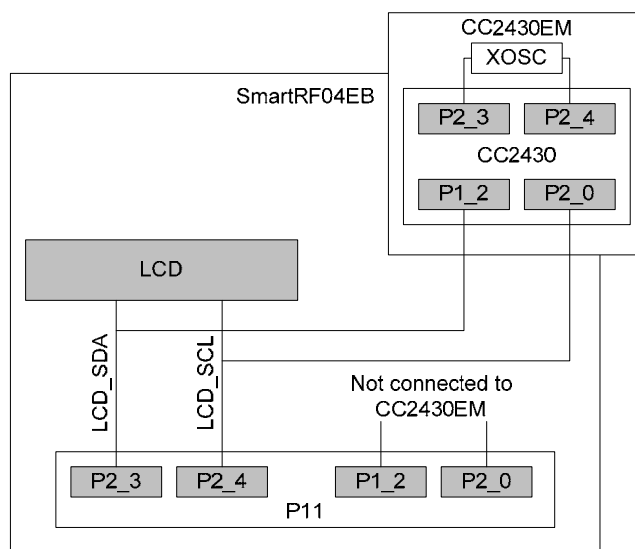


Figure 9: EM LCD connection

7 SmartRF04DK application examples

This section describes the application examples available for the CC1110, CC2510 and CC2430. All examples provide valuable information about setup and usage of different modules. The examples will be available both as source code and ready-to-upload .hex files from the Texas Instruments website.

The application examples use a menu system controlled by the joystick. Scrolling through the examples is performed by moving the joystick up or down, while selecting an example to be run is done by moving the joystick to the right. Move the joystick to the left to return from an example. As some examples are run at full speed, it might be necessary to hold the joystick to the left for a little while to return from the example.

7.1 Setup

1. Plug two Evaluation Modules into the two Evaluation Boards.
2. Connect antennas to both EM boards
3. Apply power to the Development Kits. See chapter 6.1 for more information about various ways of powering the Development Kit.
4. Turn on power by setting the power switch correctly.

For a more detailed explanation, see the “Quick Start Instructions” for the development kit in question.

The RS232/UART port is employed in some of the examples. The HyperTerminal setup is shown in chapter 7.2.2.

7.2 Examples

RF Test	Demonstrates use of the radio. Includes single, continuous, ping-pong and packet error rate (PER) mode. These examples are described further in section 7.2.1.
ADC	This example sets up single ADC sampling from the pot-meter. The acquired value is scaled to the corresponding voltage and presented on the LCD along with the decimal value. In addition, the joystick is sampled and the corresponding direction is presented with an arrow on the LCD.
ADC Series	This example sets up continuous ADC sampling of the pot-meter. Timer 1 triggers sampling. A DMA channel is set up to transfer data from the ADC. The converted values are scaled and used to present the pot-meter voltage versus time on the LCD.
Temp Sensor	The internal temperature sensor is read by the ADC and an average value is presented on the LCD.
Stop Watch	Uses timer 3 and the button to form a stopwatch. Push the button to start, push again to stop and a third time to reset the stopwatch. Timer 3 is set up to generate interrupts each m-second. These interrupts are used to increment time. The time is printed continuously on the LCD.
UART <--> LCD	Data written in HyperTerminal is sent to the SoC via the UART interface. The received data is printed on the LCD. When Enter is pressed, the data is returned to HyperTerminal.

Clock Modes	Demonstrates switching of the main clock source to either the internal RC-oscillator or the external crystal oscillator. A led is blinked according to the frequency of the oscillator currently used.
Random Sequence	The random generator is seeded with random sequence. Then, each time a new random value is needed, the random generator is clocked. In this process, the data is changed through a linear feedback shift operation. The data generated is printed on the LCD.
AES (Crypto)	Demonstrates the setup and use of the AES encryption / decryption module. Involves loading of key and initialisation vector, and utilises both the CPU and DMA for transferring data to and from the AES module.
Flash Writing	Demonstrates how to write to flash using a writing-routine located in RAM or by using DMA. Data is written using the UART. If enter is pressed, the input is written to flash. The previously written data is always displayed both in HyperTerminal and on the LCD at example start-up.
DMA	Direct Memory Access (DMA). A test string is moved from one location in ram to another using a DMA channel for data transfer. For other examples on DMA usage see "Flash Writing", "AES" or "ADC Series" examples.
Power Modes	Demonstrates how to enter and leave different power modes. Uses both sleep timer and external interrupt to wake up.
Timer Interrupts	Demonstrate how to set up and execute interrupts from 3 timers on CC1110/CC2430/CC2510. Each timer is represented on the LCD, i.e. timer 1 => T1. Beside the symbols of the timers, asterisks blink in accordance with timer timeouts.
External Interrupt	Demonstrates how to set up external interrupt from the push-button (S1).

7.2.1 RF_TEST

This example demonstrates the use of the radio through the Simple Packet Protocol (SPP), which provides an effective radio protocol with address recognition, acknowledgement, retransmission and CRC check. The SPP is interfaced through the radio functions in this example.

At start-up, determine for each node which is to be sender (master) and which is to be receiver (slave). Make sure to have one of each. The receiver will continuously be in receive, unless when replying / ACK'ing incoming packets.

If the default setting does not work due to heavy traffic from other nodes, it is possible to change frequency and node addresses in the start-up menu of this example.

The sender may be set to any of the following modes:

Single mode

Each time the joystick is moved to the right, a packet is sent. If the packet is ACK'ed, "OK" is displayed on the LCD. If the packet is not ACK'ed, the packet is retransmitted a number of times until either an ACK received, or the remote node is set as unreachable. If the latter is the case, "failed..." is displayed.

Continuous mode

Same as single mode, but the transfer is started automatically and not each time the joystick is moved to the right.

Ping-Pong mode

Transfers a packet to the remote node. The remote node transfers the packet back. The LCD displays a “ball” which is transferred between the units.

PER test mode

In this mode, the remote unit is asked to transfer 1000 packets. The local node counts the number of received packets. The packet error rate (PER, ratio of lost packets to the number of sent packets) is displayed on the LCD. A PER of 0% means that no packets were lost.

7.2.2 UART Setup

To use the UART, open “HyperTerminal” (found under: Start -> Programs -> Accessories -> Communications -> HyperTerminal). Use the following setting:

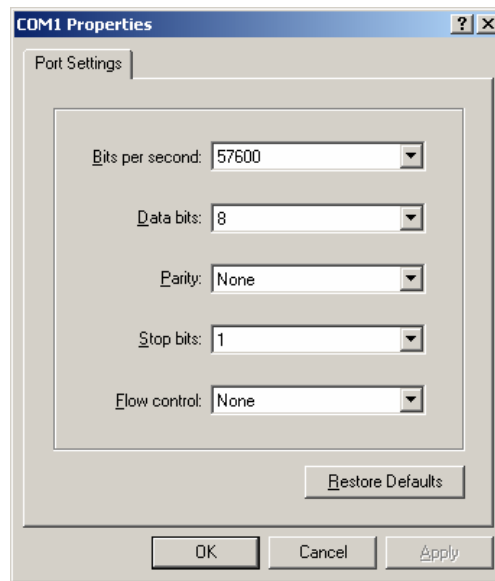


Figure 10: COM Properties

Connect an RS232 cable to the PC and the SmartRF04 EB board.

A guide to using the menu system can also be found on the Quick Start Instruction sheet that is included in the box of the development kit.

7.3 RF testing

RF testing is best performed by using SmartRF® Studio together with the Development Kit. Connect the SmartRF04DK to a PC using the USB interface. Start the SmartRF® Studio and select the SmartRF®04 tab. Select the correct Development Kit (several Development Kits can be connected to a PC at once), it should be listed as “CC2430 – new device”, “CC2510 – new device” or “CC1110 – new device”, and click the Start button. In the main SmartRF® Studio window settings can be changed, tests performed and registers adjusted. RF measurement equipment may be connected to the SMA connector on the EM.

Please see the SmartRF® Studio documentation for more information about the operation of SmartRF® Studio.

7.3.1 Output power testing

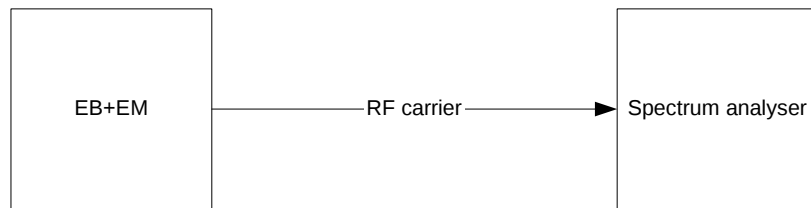


Figure 11: Output power measurement set up

Plug an EM into the SmartRF04DK, and connect the Development Kit to a PC using USB. Start SmartRF® Studio. Connect the antenna port of the EM board to a spectrum analyser using a 50-ohm RF coaxial cable. Use the simple TX function in SmartRF® Studio to set up the RF chip to emit a carrier at the desired frequency. An accurate measure of the output power can now be made. It is recommended to use a resolution bandwidth (RBW) of 3 MHz to ensure that all the RF energy is included in the measurement. Using good-quality RF cabling, the loss in the cabling should be negligible. However make sure that the spectrum analyser is calibrated. If possible, check it against a calibrated instrument such as an RF signal generator. Uncalibrated spectrum analysers can display errors of several dB.

7.3.2 Sensitivity testing

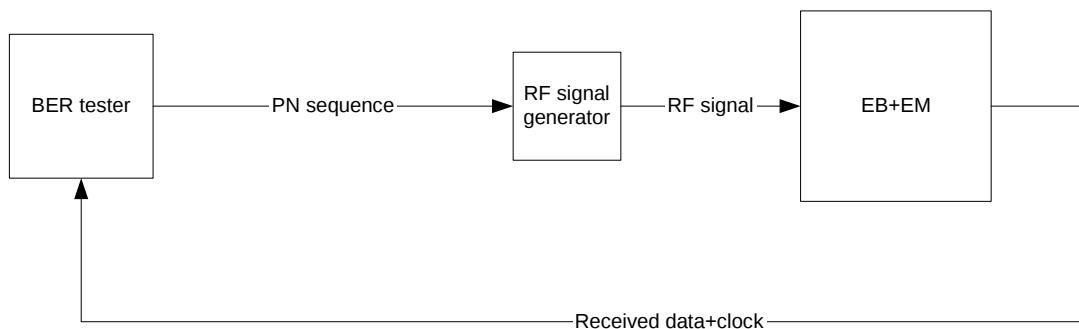


Figure 12: Sensitivity measurement set up

For proper sensitivity testing, a bit-error rate tester is needed. The exact setup will depend on the specific make of tester you are using, but in general the setup is as follows:

- The BER tester generates a pseudo-random baseband signal. This is used to modulate an RF signal generator (in some cases this is integrated in the BER tester). The modulated RF signal is then fed into the antenna connector of the EM.
- The RF chip should be configured to operate in non-buffered mode, outputting the received bit stream on the general I/O pins that are routed to the DTEST1 and DTEST2 SMA connectors on the Evaluation Board.
- The demodulated signal and clock are then fed back to the BER tester. The BER tester compares this signal with the original pseudo-random baseband signal.

The BER tester will display the number of errors measured in a scientific (e.g. 5E-6) format. Usually sensitivity is measured for a BER of 1E-3, but it is possible to use other criteria as well. Normally the RF power from the RF generator is decreased until the BER equals 1E-3. The RF power delivered by the RF signal generator at this point is the sensitivity figure.

8 Using SmartRF04EB for prototyping

SmartRF04EB includes a debug and programming interface. The debug interface is controlled by 2 communication pins. On the SmartRF04EB the interface is controlled by the USB MCU. This allows both programming and an emulator interface using the USB port.

Table 1 on page 6 shows which pins on the MCU that are used for various peripheral functions. P10 and P11 pin-row connectors can be used to connect the SmartRF04EB to another PCB or prototyping board.

8.1 Using SmartRF04EB as an In-Circuit Emulator (ICE)

The SmartRF04EB can be used as ICE both for devices connected to the EM socket and for external systems with custom applications. Figure 13 shows the main components on SmartRF04EB when it's used as ICE. Please notice that if the SmartRF04EB is used to debug an external system, the EM *shall be removed*, and vice versa.

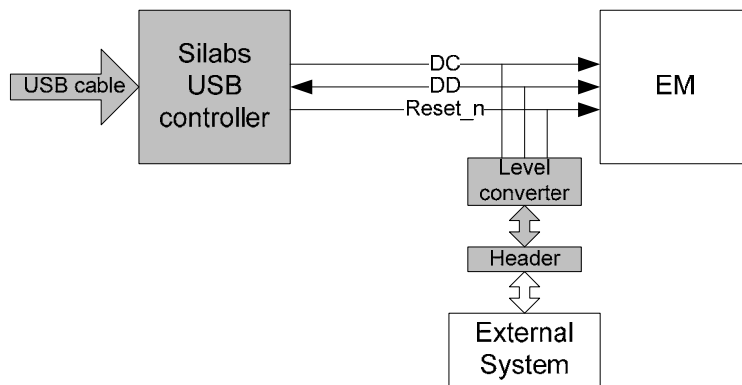


Figure 13: SmartRF04EB used as ICE

If several SmartRF04EB boards are connected to the PC's USB ports simultaneously a selection window will display the connected SmartRF04EBs, and the user can select which device to load. This is valid for all Chipcon PC software.

8.2 Debug interface

When designing applications with Chipcon SoC's it is recommended to include a pin header or test points to allow in-circuit emulation or programming using SmartRF04EB or other programming tools.

The pin-out used on the SmartRF04EB is explained in Table 4. The connector includes 4 SPI control signals. These are currently not used, but they are included for flexibility.

The SmartRF04EB includes a voltage converter to support programming and debugging of external systems with different operating voltage than the SmartRF04EB. The debug connector (P14, "SoC debug/ flash") includes two VDD connections on pin 2 and pin 9. The function is different for these connections.

Pin 2 VDD supplies voltage to the voltage converter. This pin should be connected to VDD, on the external board to assure that the correct supply voltage is used for the voltage converter. *This pin must always be connected.* The voltage on the target system must be above 2.7 V when debugged from SmartRF04EB.

Pin 9 VDD supplies VDD (3.3 V) from the SmartRF04EB. If the target application is powered from the SmartRF04EB supply during programming and debugging this pin should be connected. If the target voltage differs from 3.3V, this pin should not be connected.

The pin out used on the SmartRF04EB is explained in Table 4 and Figure 14. All signals in bold in the table are required. Figure 14 shows the required signals for a minimum connector layout.

Pin	Function	Note
1	GND	
2	VDD	Used to set correct voltage for the voltage level converter
3	Debug Clock (DC)	
4	Debug Data (DD)	
5	CSn	
6	SCLK	
7	Reset_N	
8	MOSI	
9	3.3V VDD, alt. NC	Delivers VDD from SmartRF04EB
10	MISO	

Table 4: P14 SoC debug connector pin-out

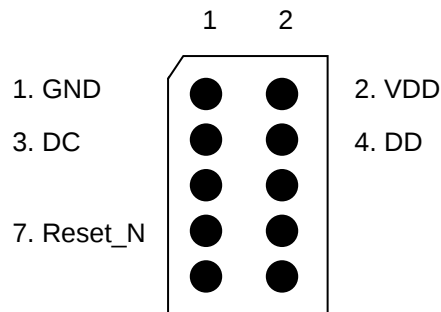


Figure 14: Recommended debug connector layout (Top view)

9 Programming the SoC with a HEX file

The SoC can be programmed from the USB interface using the Chipcon programming software. Figure 15 shows the user interface of the Chipcon Flash Programmer. For additional information regarding the Chipcon Flash Programmer please refer to the Chipcon Flash Programmer User Manual.

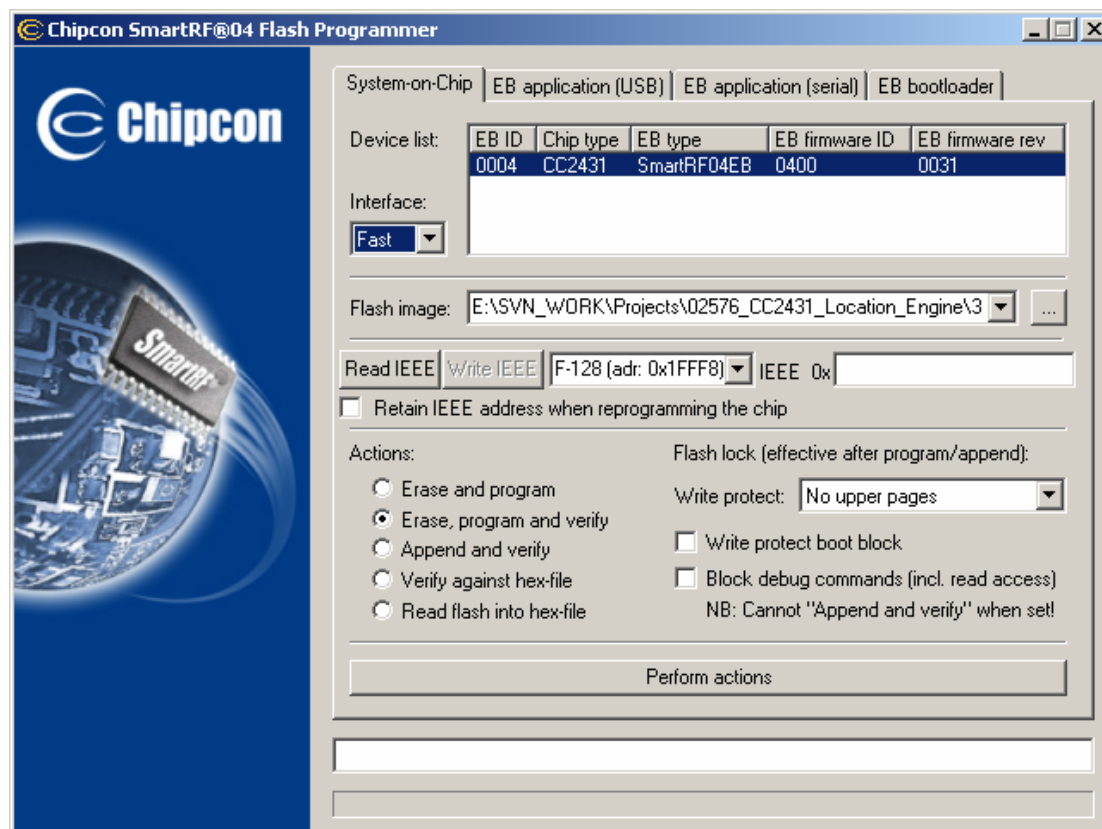


Figure 15: Chipcon Flash programmer software

10 SmartRF04DK Schematics

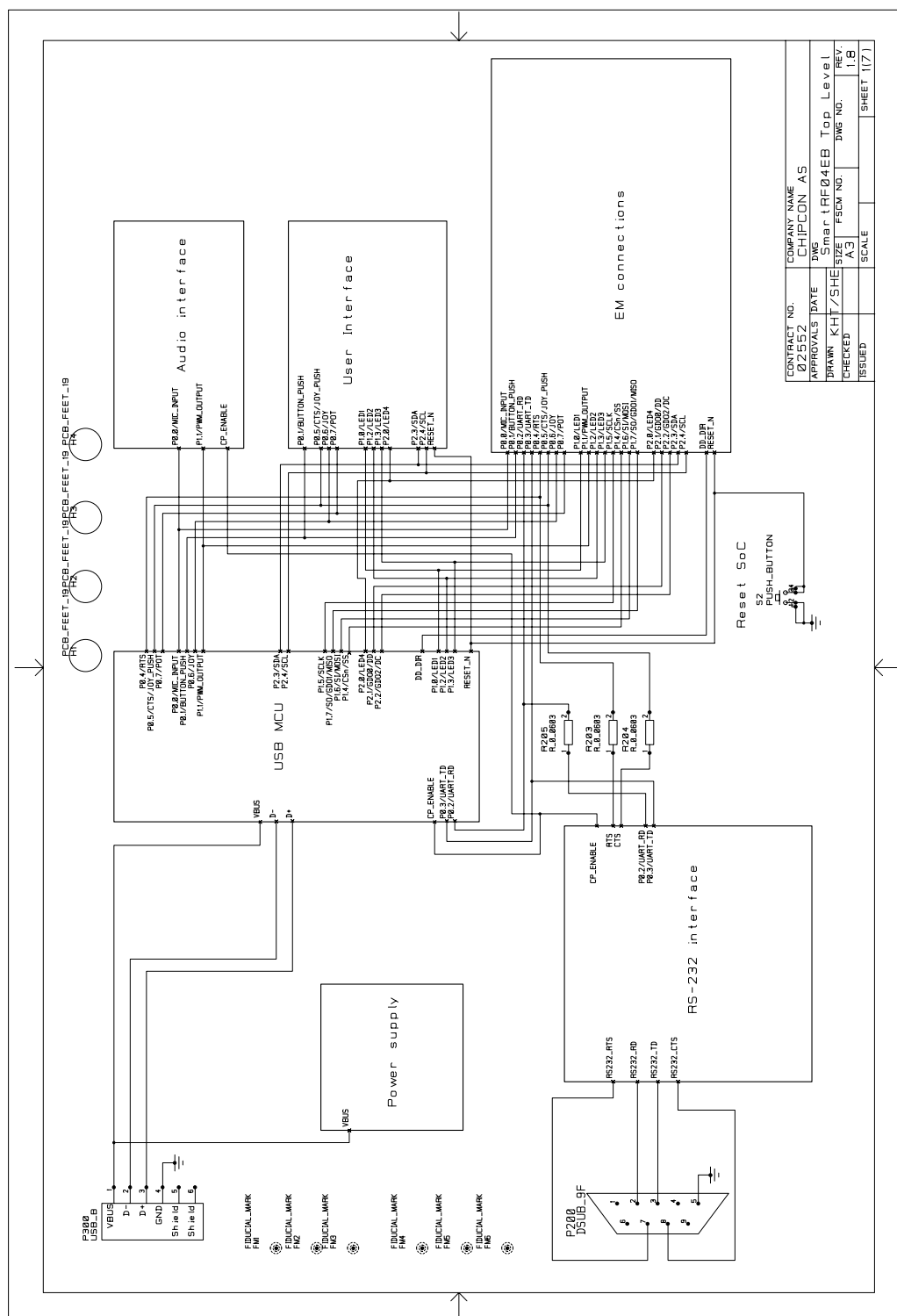


Figure 16: SmartRF04EB schematic, page 1

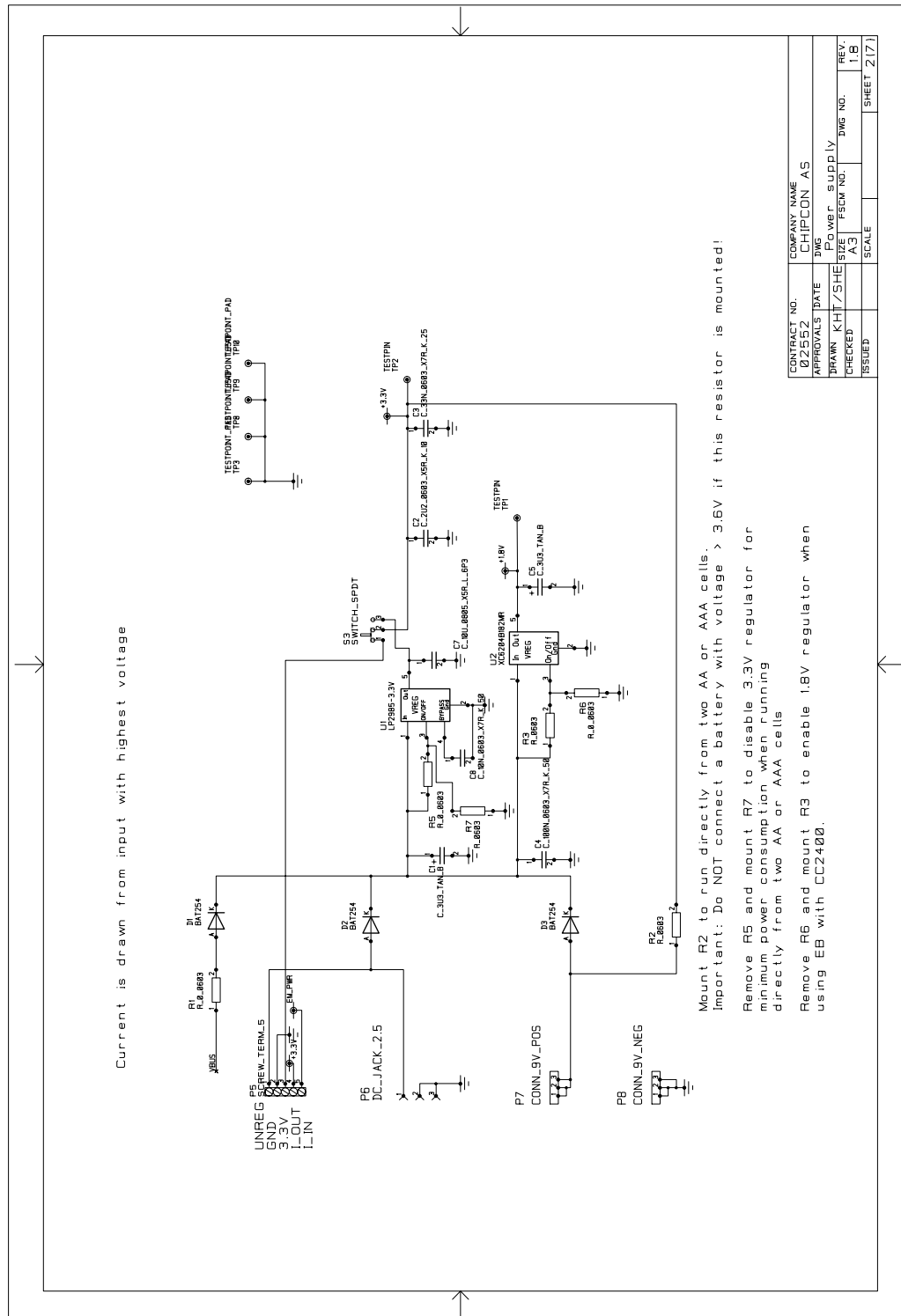
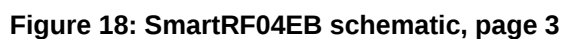


Figure 17: SmartRF04EB schematic, page 2



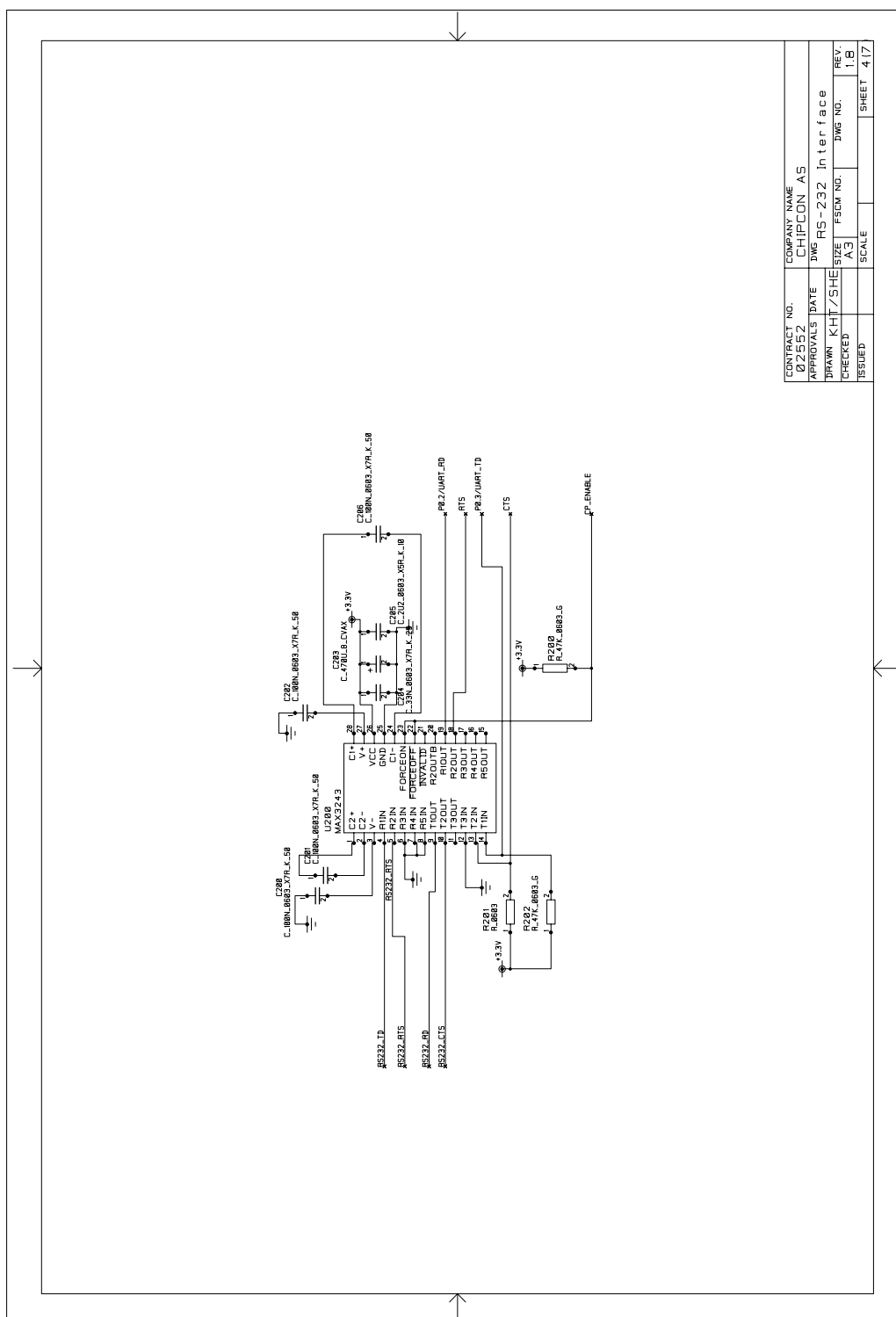
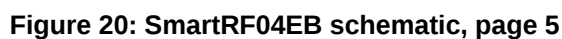


Figure 19: SmartRF04EB schematic, page 4



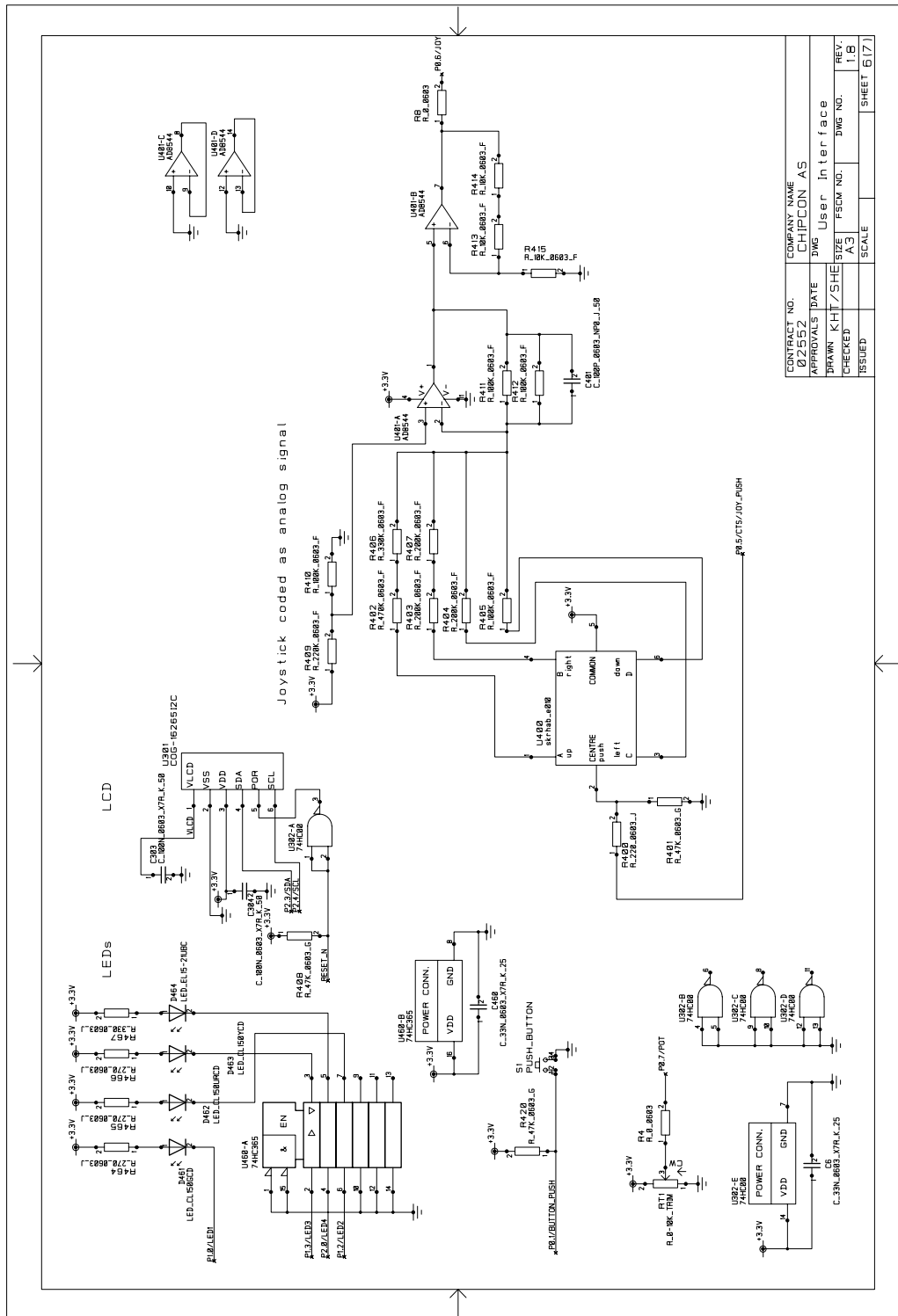


Figure 21: SmartRF04EB schematic, page 6

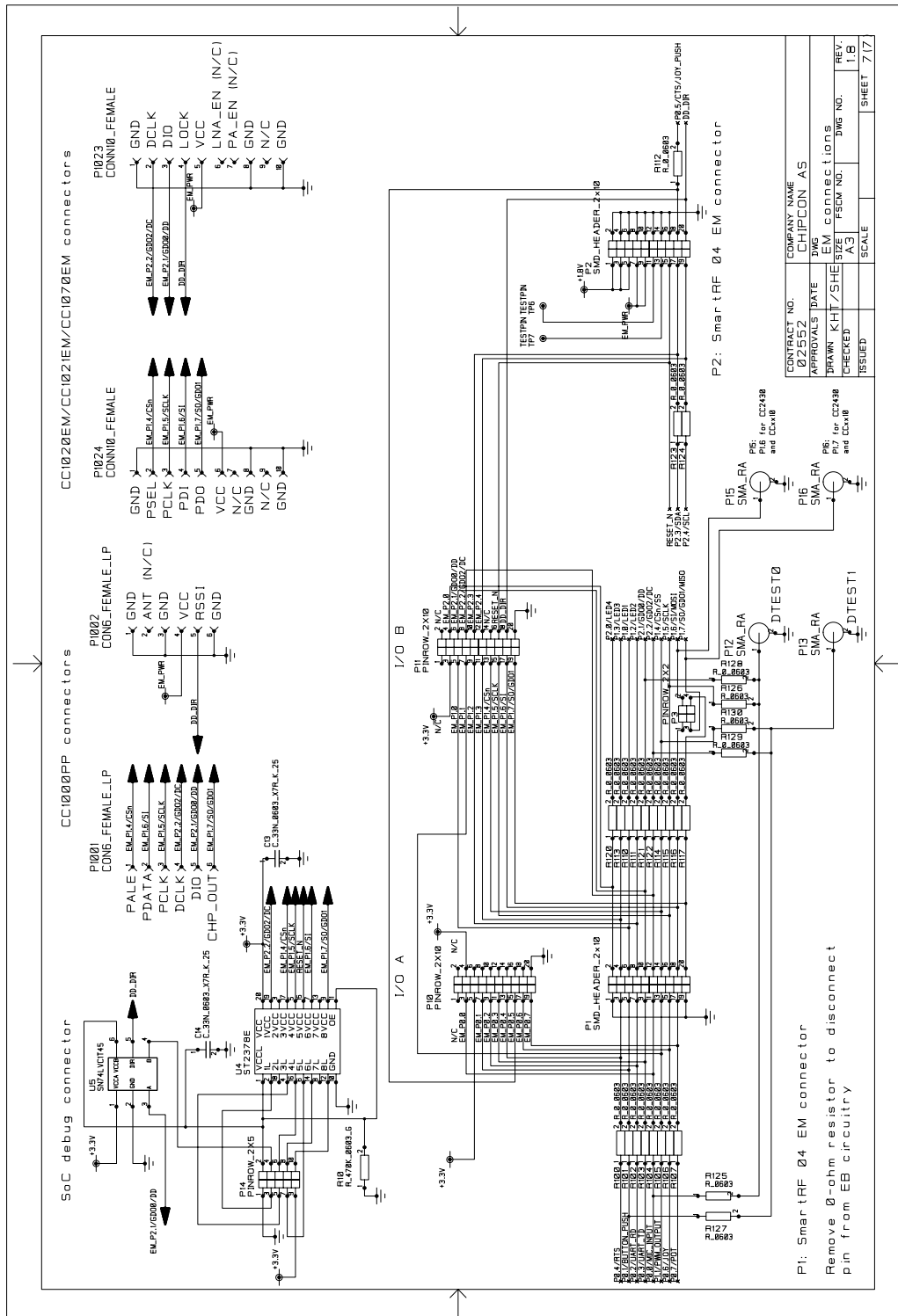


Figure 22: SmartRF04EB schematic, page 7

Revision	Description/Changes
1.9 (PCB 1.9)	Initial public release

Table 5: SmartRF04EB change list

11 Evaluation Modules

Gerber files and full documentation for the released evaluation modules can be downloaded from the Texas Instruments web site.



Figure 23: Evaluation Module

12 Document history

Revision	Date	Description/Changes
1.7	2006-10-12	Major updates in many part of the document including Table 1: typo, R101 changed to 117, Table 3 P2_0/DC changed to P2_2/DC, removed all EM schematics since the most recent versions are available on web.
1.6	2006-06-01	Minor changes
1.5	2006-02-16	Changed layout, changed P0_4/CTS to P0_4/RTS in table "USB MCU pin-out"
1.4	2006-02-06	Updated to include CC1110
1.3	2006-01-25	Added temperature sensor to examples
1.2.1	2006-01-19	Minor corrections
1.2	2006-01-10	Updated schematics and minor corrections
1.1	2005-12-28	Updated to include CC2510
1.0	2005-12-16	Initial release