



CC Debugger User's Guide



SWRU197G

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1 Introduction

The CC Debugger is primarily used for flash programming and debugging software running on CCxxxx 8051-based System-on-Chip (SoC) devices from Texas Instruments. The PC tools available for these purposes are the SmartRF™ Flash Programmer [9] from Texas Instruments and IAR Embedded Workbench® for 8051 from IAR Systems [15].

When connected to the debugger, the SoC devices can be controlled directly from SmartRF™ Studio [8]. SmartRF Studio will also be able to control supported CCxxxx RF transceivers (CC2520, CC2500, CC110x, CC11xL, CC112x, CC120x) when they are connected to the debugger as explained in chapter 6.3.

In addition, CC Debugger is used for configuring the CC85xx devices with PurePath Wireless Configurator [12] and controlling them with PurePath Wireless Commander [13].

2 Abbreviations and Acronyms

CSn	Chip Select (active low)
DC	Debug Clock
DD	Debug Data
DUT	Device Under Test
GND	Ground
LED	Light Emitting Diode
MISO	Master In Slave Out
MOSI	Master Out Slave In
RF	Radio Frequency
SCLK	Serial Clock
SoC	System on Chip
SPI	Serial Peripheral Interface
USB	Universal Serial Bus
Vdd	Positive voltage on target

3 Box Contents

- 1 x CC Debugger
- 1 x USB-A to Mini-B USB cable
- 1 x 10-pin flat cable with 2x5 2.54 mm connector
- 1 x 10-pin flat cable with 2x5 1.27 mm connector
- 1 x Converter board 2.54 mm – 1.27 mm connector
- Documentation

4 Operating Conditions of the CC Debugger

Minimum target voltage:	1.2 Volt
Maximum target voltage:	3.6 Volt
Operating temperature:	0°C to 85°C
Regulated voltage on CC Debugger:	3.3 Volt
Maximum target current (*):	200 mA (*)
Supported Operating Systems:	Microsoft® Windows® 2000
	Windows XP SP2/SP3 (32 bit versions)
	Windows Vista® (32 & 64 bit)
	Windows 7 (32 & 64 bit)

(*) Only applicable if the target is powered from the CC Debugger

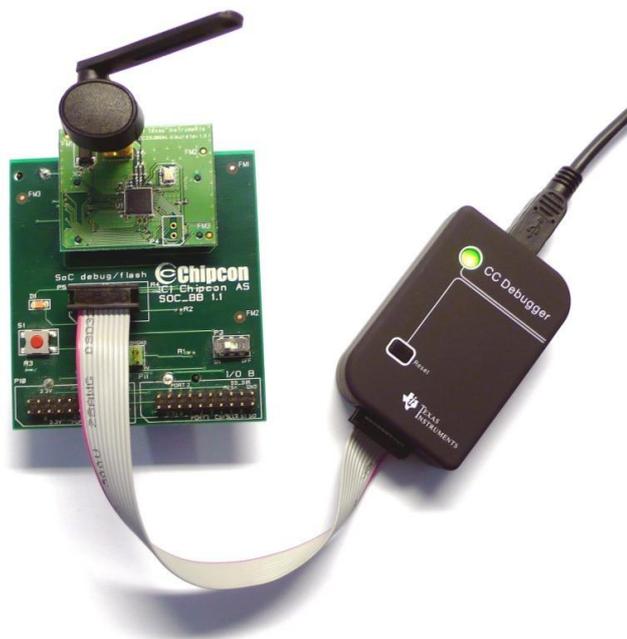


Figure 1 - CC Debugger connected to a SoC Battery Board with a CC2530EM

5 Initial Steps

5.1 Installing the USB driver

To get the required USB driver for the CC Debugger, it is necessary to install one of the tools listed below:

- SmartRF Studio www.ti.com/tool/smarrftm-studio
- SmartRF Flash Programmer www.ti.com/tool/flash-programmer
- SmartRF Packet Sniffer www.ti.com/tool/packet-sniffer
- PurePath Wireless Configurator www.ti.com/tool/purepath-wl-cfg
- PurePath Wireless Commander www.ti.com/tool/purepath-wl-cmd

Alternatively, you can download “Cebal – CCxxxx Development Tools USB Driver for Windows x86 and x64” [4] which is a standalone installer including only the device driver.

After having installed the driver, connect the CC Debugger to the PC. The USB driver will be installed automatically. You can quickly check that the debugger has been associated correctly with the USB device driver by opening the Windows Device Manager. The debugger should appear as a “Cebal controlled device”.



Figure 2 - Verify correct driver installation

For further details or troubleshooting the driver installation process, please refer to “DN304 – CCxxxx Development Tools USB Driver Installation Guide” [5].

5.2 Supported PC Tools

Currently, the CC Debugger can be used together with the following PC Tools

- **IAR Embedded Workbench for 8051** In circuit debugging of system-on-chips
- **SmartRF Flash Programmer** Flash programming of system-on-chips
- **SmartRF Studio** RF testing of radio devices (transceivers and SoCs)
- **SmartRF Packet Sniffer** Packet sniffing with selected radio devices
- **PurePath Wireless Configurator** Programming of CC85xx devices
- **PurePath Wireless Commander** Advanced control of CC85xx devices

The debugger will operate as the interface between the RF device and the tools listed above. Please ensure correct connection between the device and CC Debugger before starting to use the tools.

The connection of the device to the CC Debugger will be covered in the next chapter.

6 Connecting the CC Debugger to the Device

6.1 Target Connector Details

The target connector, located on the lateral side of the debugger, is a 10-pin 2x5 2.54 mm pitch connector with a direction coded plastic guide. Suggested matching (male) surface mounted headers would be 95278-101A10LF from FCI or BB02-HP from GradConn.

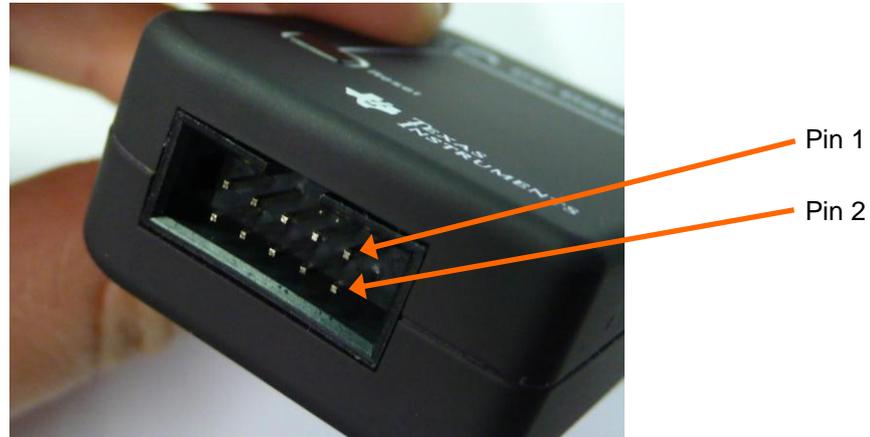


Figure 3 - Placement of Target Connector Pins

The adapter board, which has a 10-pin 2x5 1.27 mm pitch connector, has the same pin placement. Suggested matching (male) surface mounted headers would be 20021121-000-10C4LF from FCI or FTS-105-01-F-DV from Samtec.

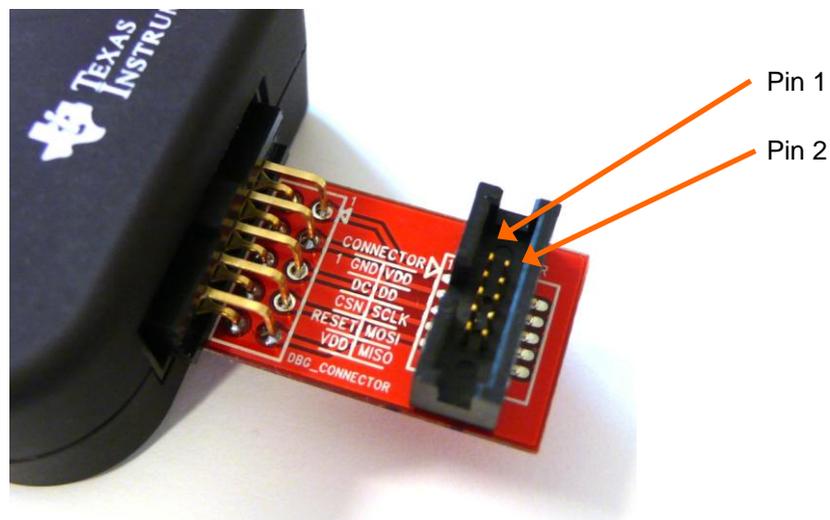


Figure 4 - Placement of Target Connector Pins on Adapter Board

The pin-out of the target connector is shown in Figure 5. Note that not all of these pins need to be connected to the target device for programming and debugging. Only Vdd, GND, DD, DC and RESET are required for System on Chips. The other pins are optional and/or for special features.

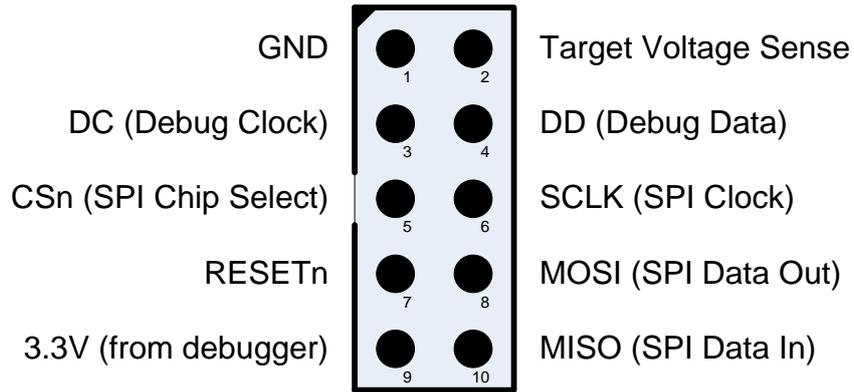


Figure 5 - Target Connector Pin-out

Please note the concept with the target voltage sense signal. This signal is used by the level converters on the CC Debugger to handle different voltage levels on the target board and the debugger. Pin 2 on the target connector must be connected to Vdd on the target board.

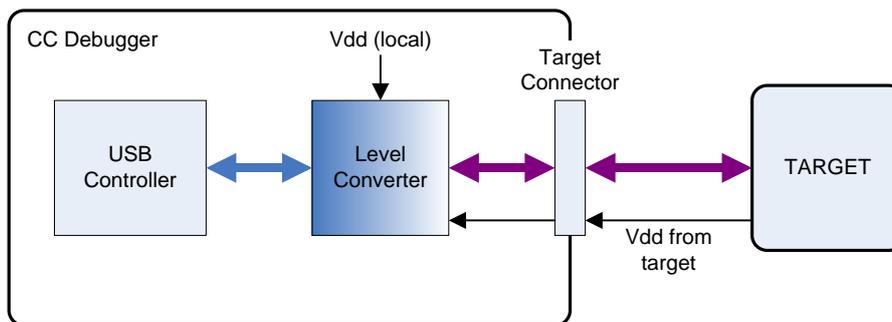


Figure 6 - Voltage from target to CC Debugger

Alternatively, it is possible to power the target by connecting pin 9 to Vdd on the target. In that case, the CC Debugger will supply 3.3V to the target.

6.2 Connecting the CC Debugger to a System on Chip

6.2.1 Minimum connection for debugging

For successful debugging of a TI 8051-based RF System on Chip, connect the two debug signals Debug Data (DD) and Debug Clock (DC) and the reset signal RESETn to the device. Note that DD is a bidirectional signal. In addition, the CC Debugger must be connected to GND and Vdd on the board. Vdd is used as an input to the level shifters on the CC Debugger, thus allowing a different operating voltage on the target than internally on the debugger.

For CC111x, CC251x, CC243x, CC253x and CC254x, *except CC2544 and CC2545*, connect the DD signal to pin P2.1 and DC to pin P2.2.

For CC2544, connect the DD signal to P1.3 and DC to P1.2.

For CC2545, connect the DD signal to P1.3 and DC to P1.4.

Note that it is possible to power the target board from the debugger by connecting the 3.3V signal on pin 9 on the connector to the target board.

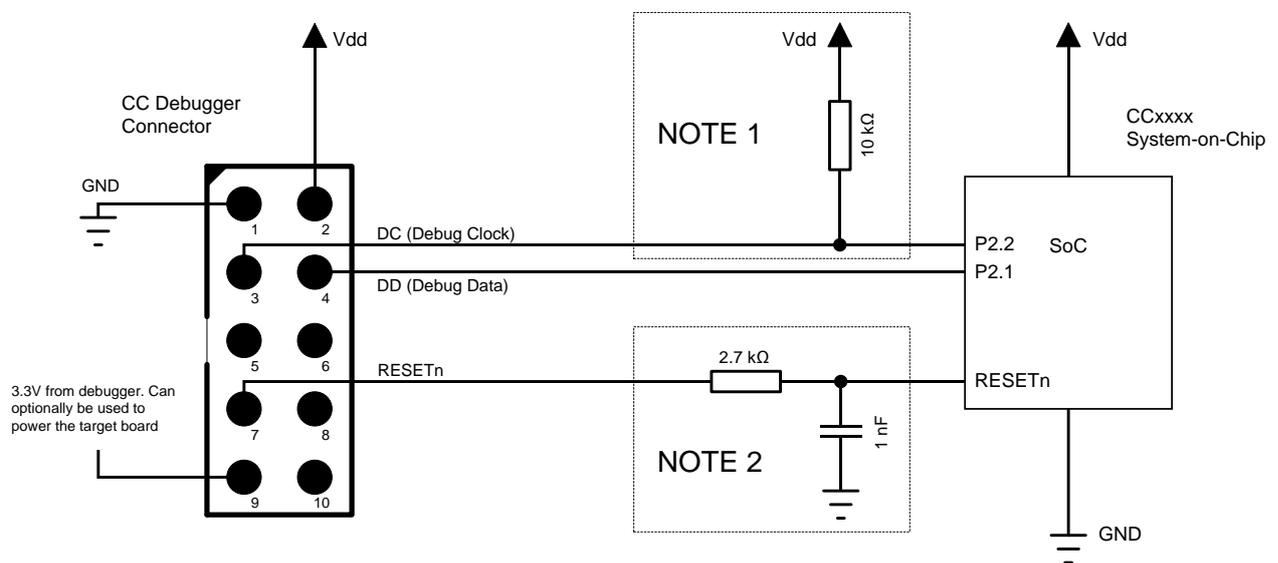


Figure 7 - Minimum connection for debugging of 8051 SoC

Note 1: Some early revisions of certain SoCs (CC2430, CC2510 and CC1110) needed an external pull-up to avoid unwanted transitions on the debug clock line during chip reset – thus inadvertently setting the device in debug mode. All new revisions of all SoCs now have an internal pull-up on P2.2, so this external component is not required.

Note 2: The RESETn pin is sensitive to noise and can cause unintended reset of the chip. For reset lines susceptible to noise, it is recommended to add an external RC filter. Please refer to the respective SoC datasheet and reference designs for recommended RESET circuitry. The CC Debugger supports slow transitions on the reset line, using a 2 ms delay between any transition on the RESET line and other transitions on the DC and/or DD lines.

6.2.2 Minimum connection for SmartRF Studio

Use the same connection as for debugging the SoC.

6.2.3 Minimum connection for SmartRF Packet Sniffer

In order to use the packet sniffer capabilities of the CC Debugger, it is also necessary to connect the SPI bus to the SoC. The SPI interface is used by the CC Debugger for reading the captured RF packets from the SoC.

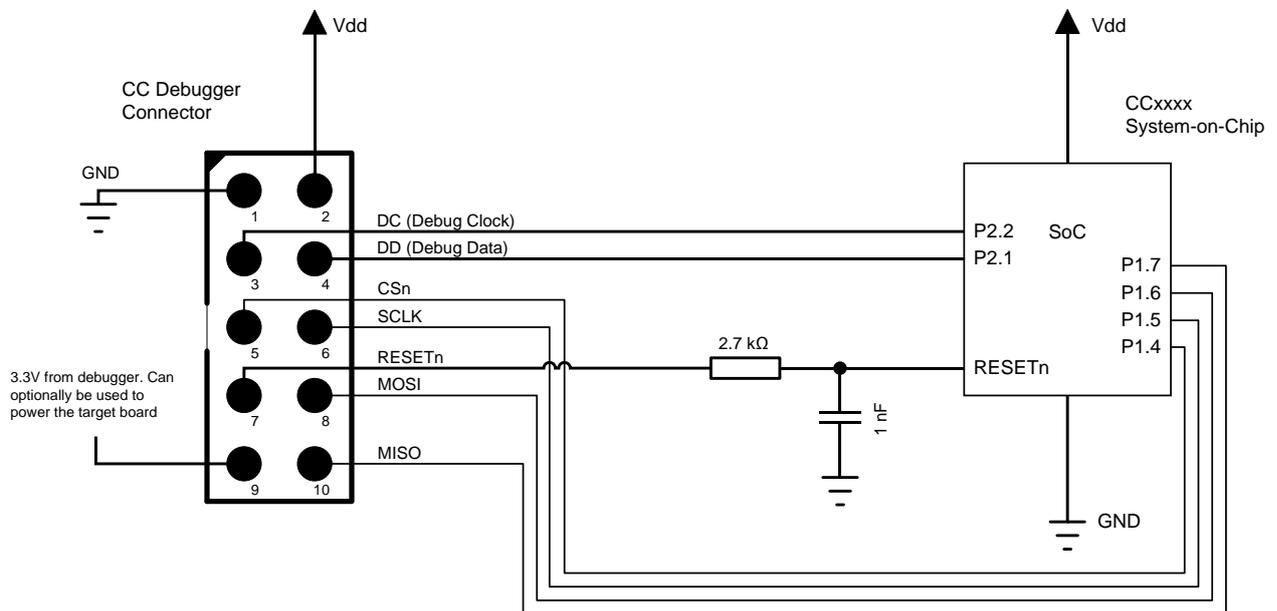


Figure 8 - Connection to SoC to enable Packet Sniffing

Note that the packet sniffer will overwrite the flash on the SoC with special packet capture firmware.

Note concerning the SPI interface to the SoC used for packet sniffing

All of the current TI RF SoCs can be configured to operate as SPI slaves, with the SPI signals (CS, SCLK, MISO and MOSI) going to one of the USART peripherals. The packet sniffer application will program the SoC with firmware that configures one of the USART peripherals in order to communicate with the CC Debugger. The firmware can use any of the four possible pin configurations (USART 0 or 1, pin out alternative 1 or 2). However, only a subset is currently supported:

	USART0, alt 1	USART0, alt 2	USART1, alt 1	USART1, alt 2
CC243x	-	-	-	OK
CC253x/CC254x	-	-	-	OK
CC111x	OK	-	-	OK
CC251x	OK	-	-	OK

Table 1 - Supported SPI connections (marked OK)

	USART0, alt 1	USART1, alt 2
SCLK	P0.5	P1.5
CS	P0.4	P1.4
MOSI	P0.3	P1.6
MISO	P0.2	P1.7

Table 2 - USART pin out details

In case of multiple supported interfaces, the Packet Sniffer application will let you choose which interface to use.

6.3 Connecting the CC Debugger to a Transceiver

The SPI interface on the CC Debugger can be used to interface many of the CCxxx transceivers and control them from SmartRF Studio. The transceivers/transmitters/receivers currently supported are:

- CC1100
- CC1101
- CC1120
- CC1121
- CC1125
- CC1175
- CC110L
- CC113L
- CC115L
- CC1200
- CC1201
- CC2500
- CC2520

Note that the CC Debugger operates as the SPI Master. In a multi master system, it is necessary to make sure the debugger output signals (DC, DD, CSn, SCLK, MOSI and RESETn) do not interfere with the other SPI master on the board. The other SPI master would typically be the microcontroller on the board.

The connection diagrams below show the interconnection between the debugger and the various supported transceivers.

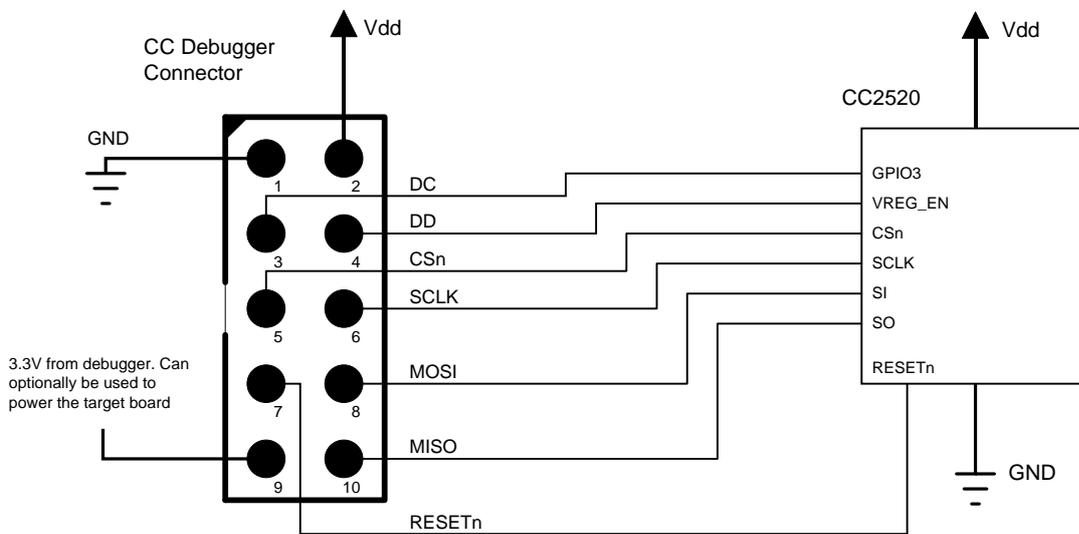


Figure 9 - CC Debugger connected to CC2520

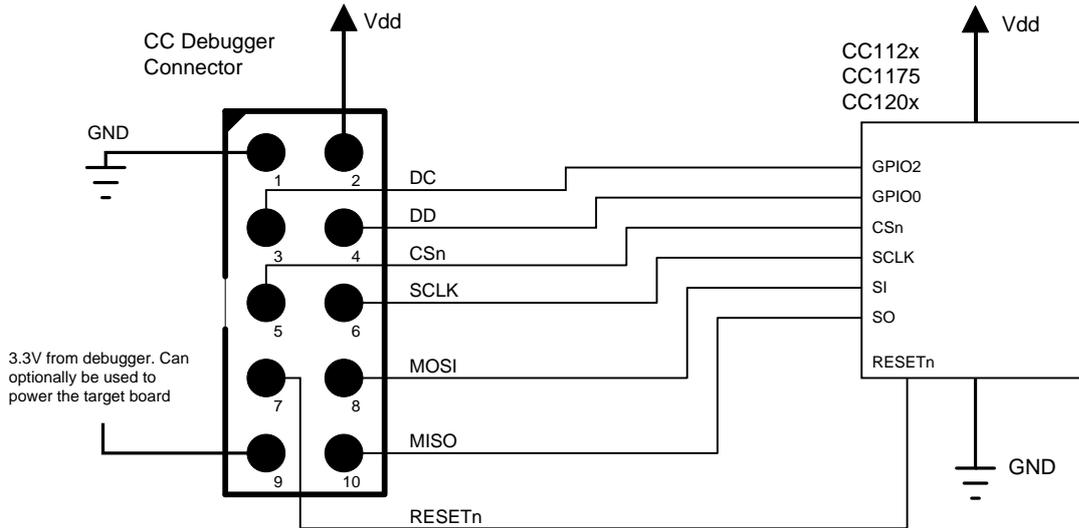


Figure 10 - CC Debugger connected to CC112x/CC1175/CC120x

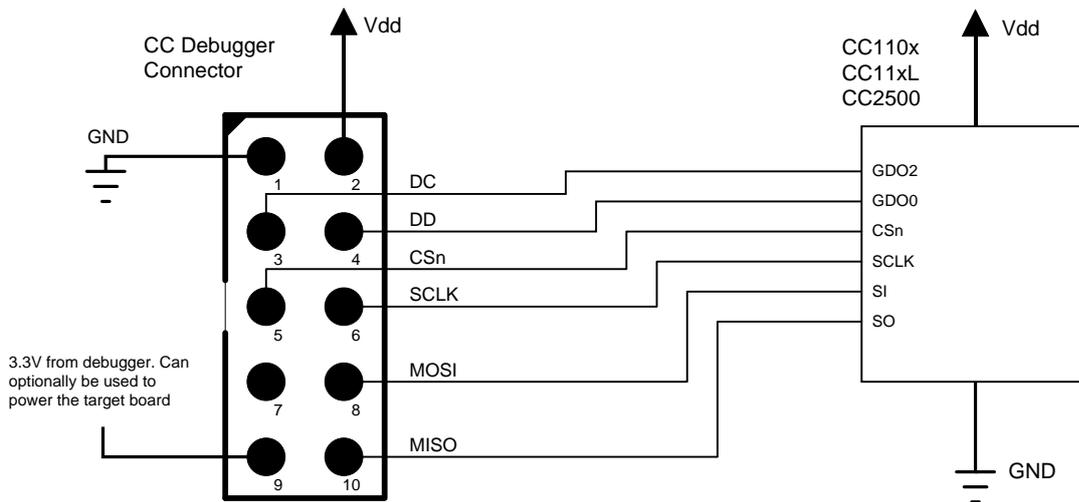


Figure 11 - CC Debugger connected to CC110x/CC11xL/CC2500

6.4 Connecting the CC Debugger to a CC85xx

In order to configure the CC85xx devices (i.e. program the flash on the device) with PurePath Wireless Configurator, the device's SPI interface must be connected to the CC Debugger as shown in the figure below.

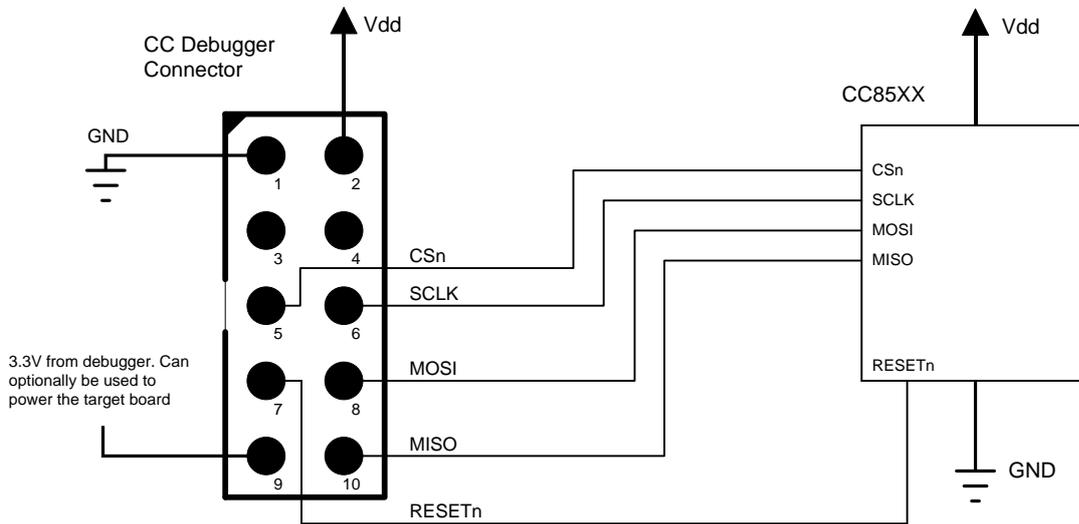


Figure 12 - CC Debugger connected to CC85XX

7 Using the CC Debugger

After having connected the debugger to the target device, the debugger can be powered up by plugging in the USB cable.

The debugger will immediately start a device detection process, looking for all known devices. If no devices are detected, the LED will be RED. If a device is detected, the LED will be GREEN.

If the LED is GREEN, it is possible to start using the debugger together with one of the supported PC tools.

7.1 Understanding the LED

OFF



The debugger has no power or there is no valid firmware on the debugger. Make sure the debugger is properly powered via the USB cable or try to resurrect the debugger using the method described in chapter 8.4.

AMBER (BOTH LEDS ON)



The debugger is powered, but there is no valid firmware. Try to resurrect the debugger using the method described in chapter 8.4.

RED LED BLINKING

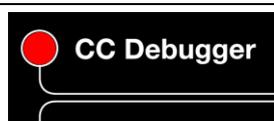


The Debugger is in Boot Recovery Mode.

The debugger will briefly enter this state while the firmware is being upgraded (see chapter 8). The board might also enter this state if the firmware is corrupt or if the user has manually forced to board to start up in the special "boot recovery mode" (section 8.3).

To go out of the state, reset the debugger by pressing the "Reset" button or by power-cycling the device. If the LED is still blinking, reprogram the unit by using the Flash Programmer Application.

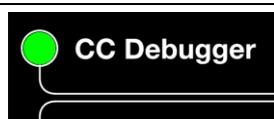
RED LED ON



No device detected. This might be due to old firmware on the CC Debugger. New devices might not be supported with the current firmware on the debugger. Please refer to chapter 8 for the firmware upgrade procedure.

There might also be a problem with the hardware connection. Check the connection to device and make sure the target board is properly powered and that Vdd on the target board is connected to pin 2 on the debug connector. Press and release the reset button to retry the target device detection

GREEN LED ON



The target device has been properly detected. It is possible to start using the supported tools (see chapter 5.2).

8 Updating the Firmware

In order to make sure the CC Debugger works seamlessly with your device, it is important that it has the latest and greatest firmware. This chapter will describe how you can upgrade the firmware automatically from SmartRF Studio or manually from SmartRF Flash Programmer. The chapter will also describe how to resurrect a seemingly broken debugger.

8.1 Updating the firmware automatically in SmartRF Studio

Updating the firmware on the CC Debugger can be done automatically by SmartRF Studio. Please follow the few steps described below.

1. Start SmartRF Studio.
2. Disconnect the debugger from any target board, and connect it to the PC via the USB cable. The debugger will appear in the list of connected devices in the lower part of the SmartRF Studio startup panel.

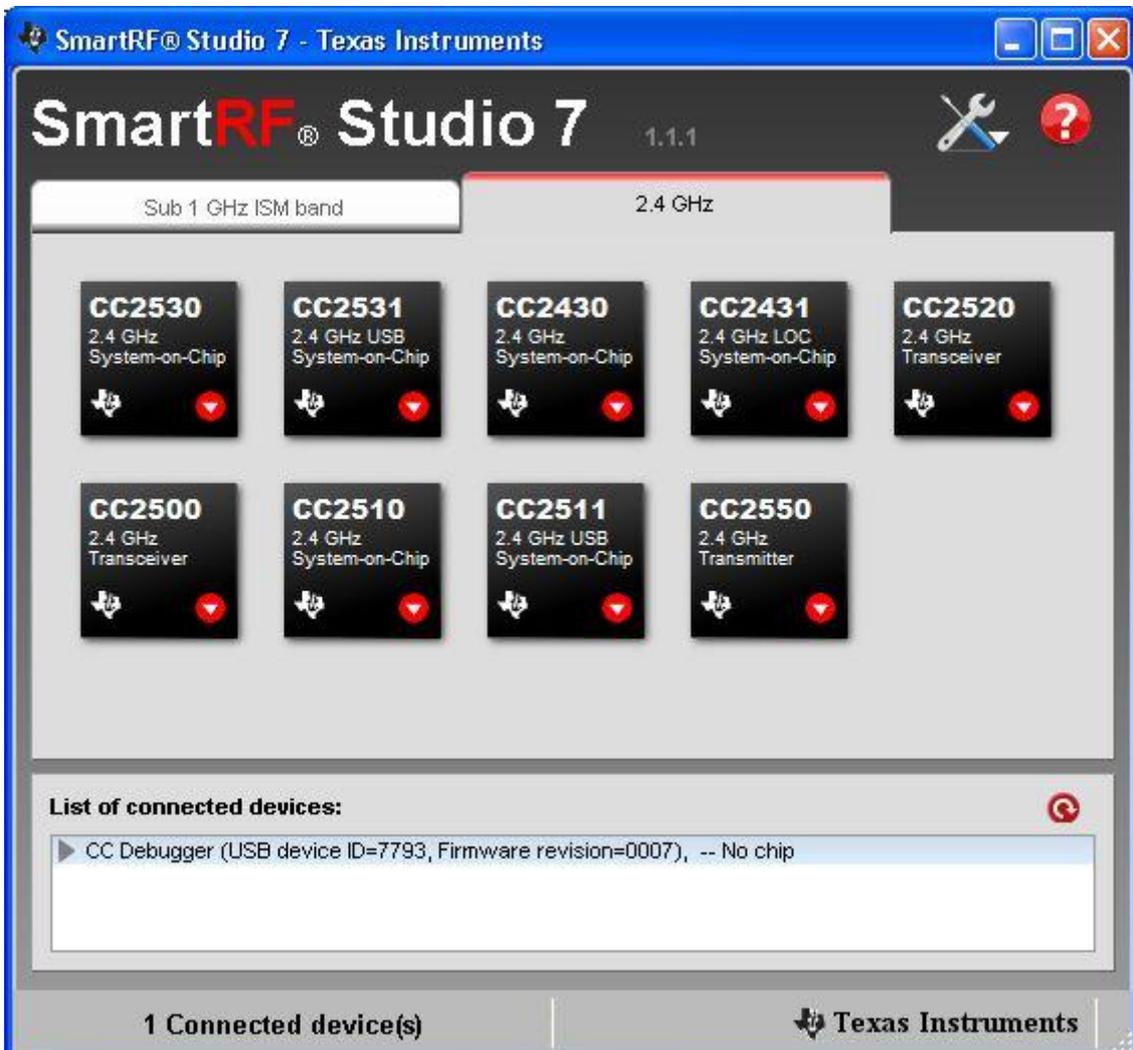


Figure 13 - Auto FW upgrade

3. Double click on the item in the list, and a new window will appear.



Figure 14 - Auto FW upgrade

4. Click "Yes" and let SmartRF Studio do the rest.



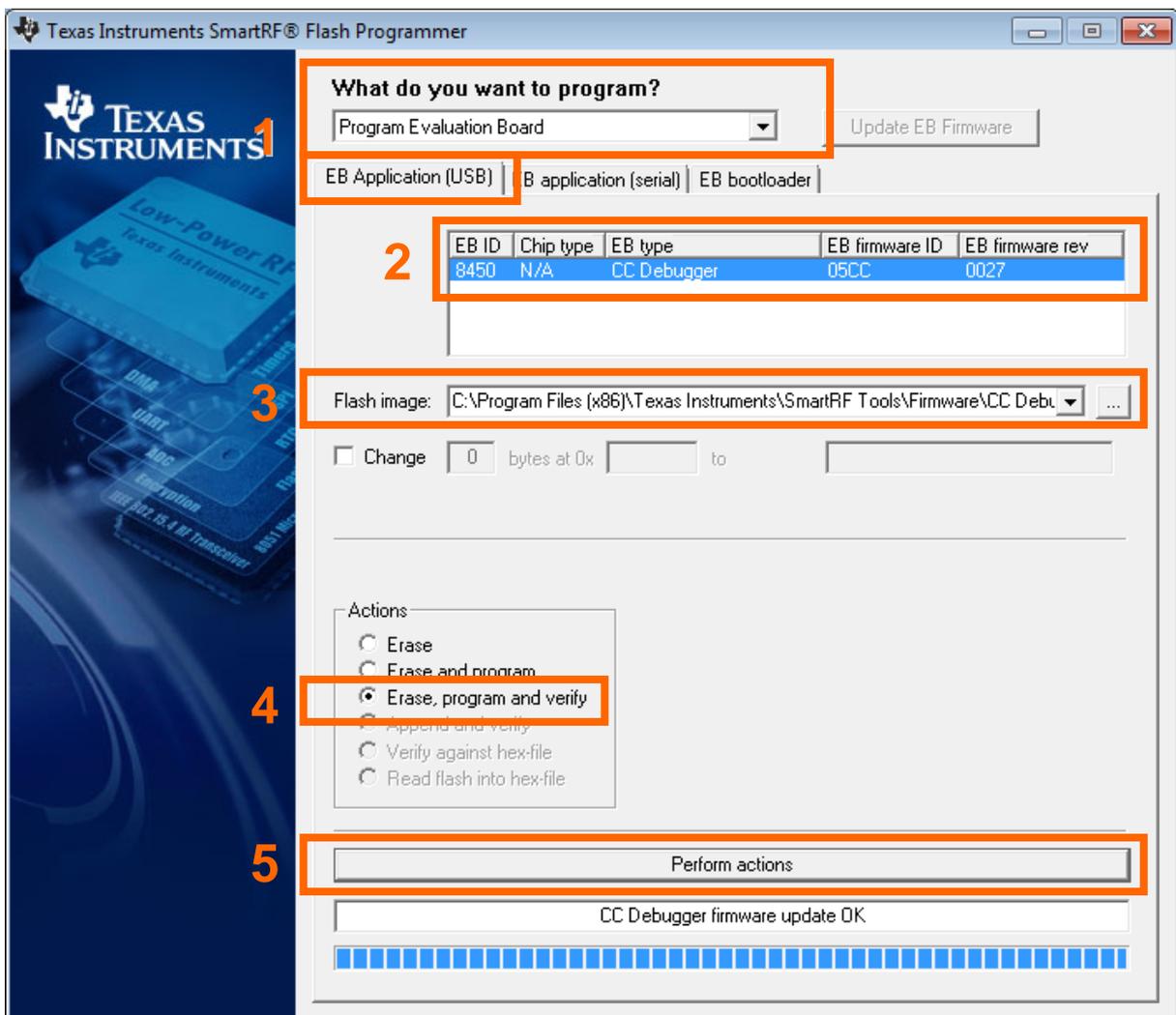
Figure 15 - Auto FW upgrade

5. Click "Done" and you're good to go. The device should appear in the list of connected devices, now showing the new firmware revision.

8.2 Updating the firmware manually in SmartRF Flash Programmer

You can also update the firmware manually using SmartRF Flash Programmer. You can use this method if you like to have full control of the firmware image to be programmed on the controller of the debugger (i.e. programming custom firmware or old firmware revisions).

1. Start SmartRF Flash Programmer and select the tab called “EB application (USB)”. This tab will let you program compatible firmware on the CC Debugger (or evaluation boards) via the USB interface (i.e. no external programming device required).
2. Disconnect the debugger from any target board, and connect it to the PC via the USB cable. The debugger will appear in the list of connected devices. Chip type will be listed as N/A.
3. Select the flash image you want to program on the debugger. Normally, you would select: C:\Program Files (x86)\Texas Instruments\SmartRF Tools\Firmware\CC Debugger\cebal_fw_srf05dbg.hex¹
4. Select the action “Erase, program and verify”
5. Click the “Perform actions” buttons. The programming procedure will start. Note that this will take several seconds.
6. The CC Debugger will reappear in the list of connected devices, now showing the new firmware revision in the device list.
7. Done!



¹ Assuming default installation path of SmartRF Flash Programmer.

8.3 Forced boot recovery mode

If, for some reason, the firmware update fails and the CC Debugger appears to be non responsive, there is a way to force the board to only run the bootloader and stop all further execution. In this mode, no attempts will be made to start the firmware, and the board will only allow the user to perform a new firmware upgrade over USB.

Disconnect the debugger from any power source and open the plastic enclosure.

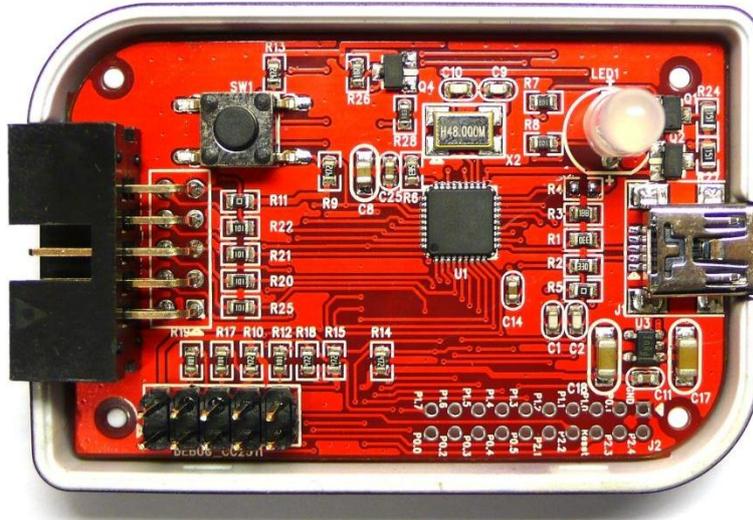


Figure 16 - Internal view of CC Debugger

Short circuit the pins as depicted in Figure 17: P1.6 on the CC2511 must be connected to GND during the power-on reset to enter boot recovery mode.

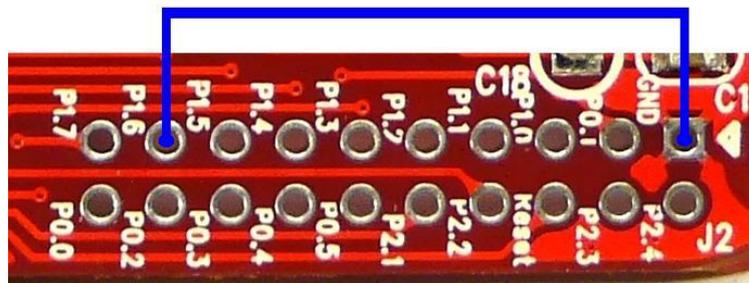


Figure 17 - Short-circuit pins for boot recovery mode

When reconnecting the USB cable, the LED will start to blink with a RED light. This indicates that the bootloader is running and that the debugger is in boot recovery mode.

At this point, follow the same firmware programming steps as describe at the beginning of this chapter.

Please also note that the boot recovery mode can be used as a check to verify that the bootloader on the debugger is working.

8.4 Resurrecting the CC Debugger

If the CC Debugger appears to be completely dead when applying power, there is a way to “unbrick” the board. The method consists of reprogramming the bootloader on the debugger using the debug connector inside the box. This will require an extra programming device.

When opening the box, locate the debug connector header next to the target connector. Connect this header to another CC Debugger (see Figure 18) or to a SmartRF05EB (see Figure 19). When using

SmartRF05EB, connect a 10-pin flat cable from the “Ext SoC Debug” plug (P3) on the EB to the “USB Debug” plug (P2) on the CC Debugger. The dead debugger needs power, so connect the USB cable. Turn on the SmartRF05EB or debugger - it should detect the USB Controller (CC2511) on the debugger.



Figure 18 - Programming the bootloader on the CC Debugger using another CC Debugger

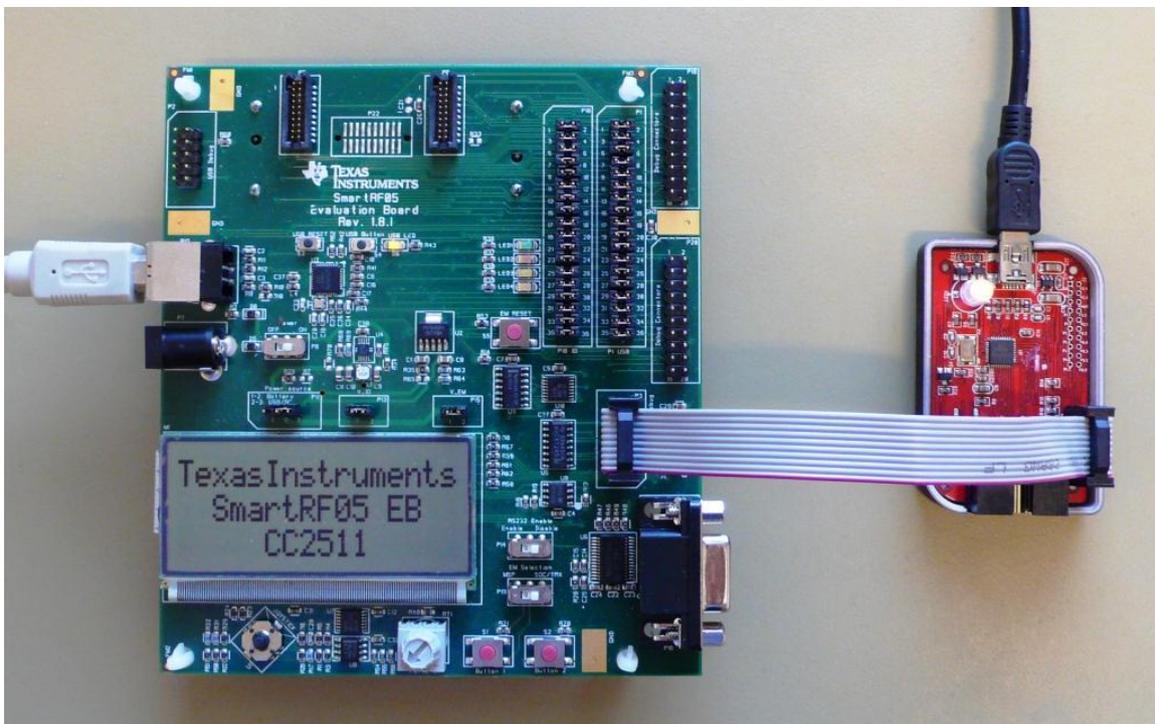


Figure 19 - Programming the bootloader on the CC Debugger using SmartRF05EB

Next, use the SmartRF Flash Programmer to program the bootloader on the debugger. Follow these five steps (illustrated in Figure 20 below):

1. After starting the application, first select “Program Evaluation Board” in the “What do you want to program?” drop down box, then select the “EB Bootloader” tab.
2. In the upper left corner, select device: Use SmartRF05EB regardless of the device being used to program the debugger. I.e. select SmartRF05EB both when you are using a CC Debugger and when you are using a SmartRF05EB for the resurrection.
3. Next, select which flash image to program. The bootloader image is included when installing the flash programmer and it is usually located at “C:\Program Files (x86)\Texas Instruments\SmartRF Tools\Firmware\CC Debugger”.
4. It is also necessary to give the debugger a unique ID number – any 4 digit number will work. This number is used by the driver on the PC to uniquely identify devices if more than one debugger is connected at the same time.
5. Select “Erase, program and verify”
6. Press the “Perform Actions” buttons. The firmware upgrade takes a few seconds.

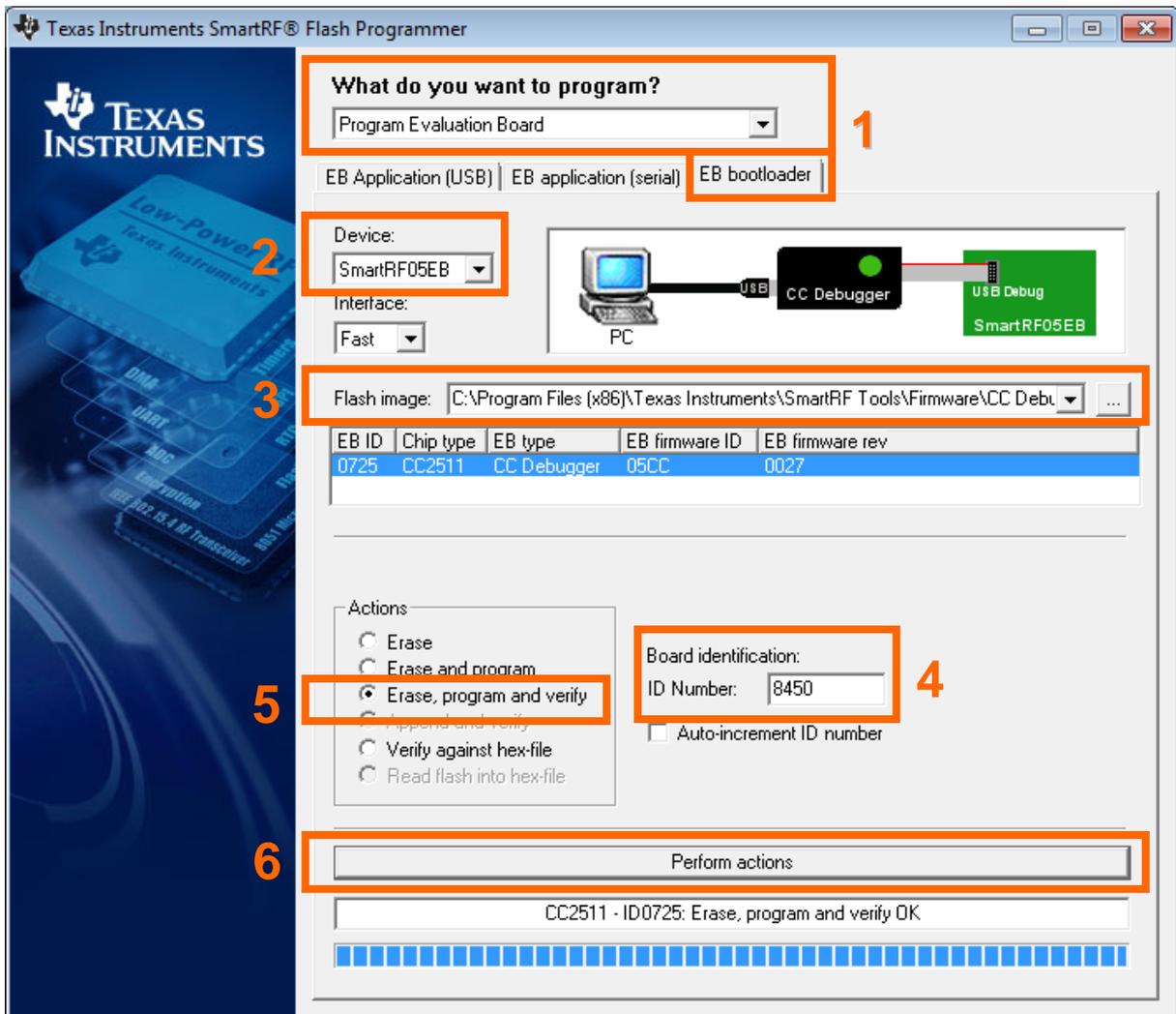


Figure 20 - SmartRF Flash Programmer - Updating the bootloader

Once the bootloader is programmed, you might be asked to install a USB driver on the PC. Just follow the same procedure as when the debugger was connected to the PC the first time (see chapter 5).

The RED LED on the debugger should now be blinking, indicating that the bootloader is running but that no application has been loaded. If the RED LED is off, there is probably something wrong with the hardware. The debugger firmware can now be programmed directly over USB by following the procedure in either chapter 8.1 or 8.2.

9 Troubleshooting

Q1 Help! The debugger does not detect the SoC. What should I do?

A1 There are several things to check.

Upgrade the firmware. Many CC Debuggers have old firmware that will not automatically detect newer devices, like CC2543/44/45. Refer to chapter 8 for further instructions.

Check that the cable is oriented correctly and that the pins are connected to the right signals on the debugger.

Check that the debugger gets power from the target (i.e proper connection of the Target Voltage Sense signal). This is required in order for the level converters on the debugger to work.

Check that ground on the target is connected to ground on the debugger. This is normally achieved through the target connector. Note that since the ground planes are the same, please be aware of any adverse effects caused by different ground planes on the target and on the PC (grounded via USB cable).

Check that the cable is not broken. Especially the small flat cable is prone to stop working if handled a lot or being bent and stretched beyond normal operating conditions.

Q2 Does IAR EW8051 support the CC Debugger as debugging device?

A2 Yes – but make sure you have an up to date version of IAR with the new debug driver plug-in from Texas Instruments. You will need version 7.51A or higher.

Q3 Can the debugger be used as an interface to the RF device for packet sniffing?

A3 Yes, this is supported for selected devices. Use the same interconnection as in the diagrams in chapter 6.

Q4 Is there a way to remove the plastic casing without damaging it?

A4 Yes, there is. Hold the bottom piece of the plastic in one hand. With your other hand, take a firm grip on the long lateral sides of the upper part of the plastic and squeeze while moving the upper part away from the bottom. The two parts should separate from each other.

To reassemble the plastic, just click the two pieces together.

Q5 Is this a Mini or a Micro USB plug?

A5 Mini USB type A.

Q6 I have two CC Debuggers with the same EB ID, and I'm unable to use them together. What do I do?

A6 Two EBs with the same EB ID cause a driver conflict. The solution is to resurrect one of the CC Debuggers and give it a new EB ID.

1. Connect one CC Debugger to your computer
2. Connect the CC Debugger you want to resurrect to a separate power source (e.g. another computer or a USB charger).
3. Follow the steps for resurrecting the CC Debugger, described in section 8.4.

10 Schematics

See last page or refer to the complete bundle including gerber files, schematics and layout here [3].

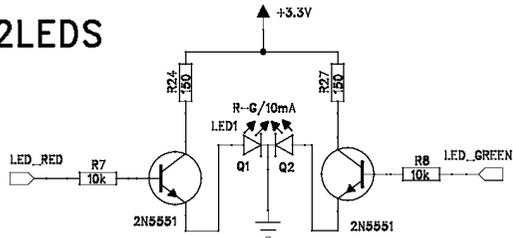
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- [14] SoC Battery Board product web site
www.ti.com/tool/soc-bb
- [15] IAR Embedded Workbench for 8051
www.iar.com/ew8051

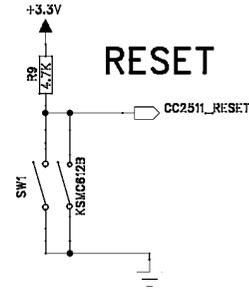
12 Document History

Revision	Date	Description/Changes
G	2013-01-15	Chapter 9: Added how to solve problem with CC Debuggers having the same EB ID.
F	2013-06-20	CC1100, CC1101, CC2500, and CC1200 are now also supported by the debugger. Corrected typo in chapter 6.2.1: DD to pin P2.1 (not P2.2) and DC to pin P2.2 (not P2.1) for all SoCs except CC2544 and CC2545. Added debug pin-out for CC2545. Corrected pin-out in figure 10 and 11 (DC to GPIO2/GDO2, DD to GPIO0/GDO0). Added link to layout and gerber files.
E	2012-03-01	Corrected typo in chapter 6.2.1. Special debug pin-out for CC2544, not CC2543.
D	2012-02-22	Added information about connections for programming of CC85xx devices. Updated info about connections for supported transceivers. Updated driver installation information and added more details about firmware upgrade. Describe what it means when the LED is amber. Updated reference links.
C	2010-09-19	Added more information about how to upgrade the firmware.
B	2010-02-25	Fixed erroneous description of interconnection between CC Debugger and CC2520. The VREG_EN signal shall be connected to pin 4 on the target connector, not pin 3.
A	2010-02-11	Added more details about the powering options. Added more information about connection options.
-	2009-05-05	First revision.

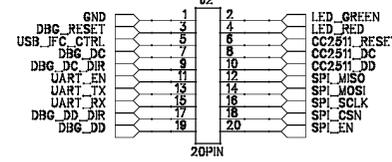
2LEDS



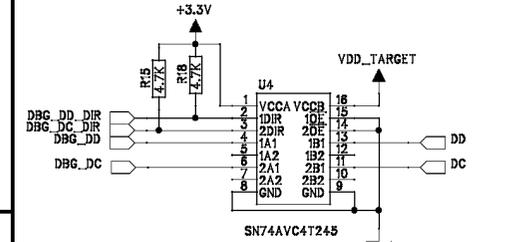
RESET



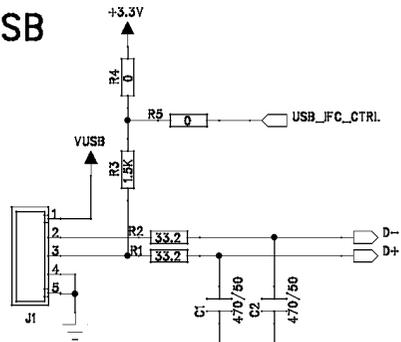
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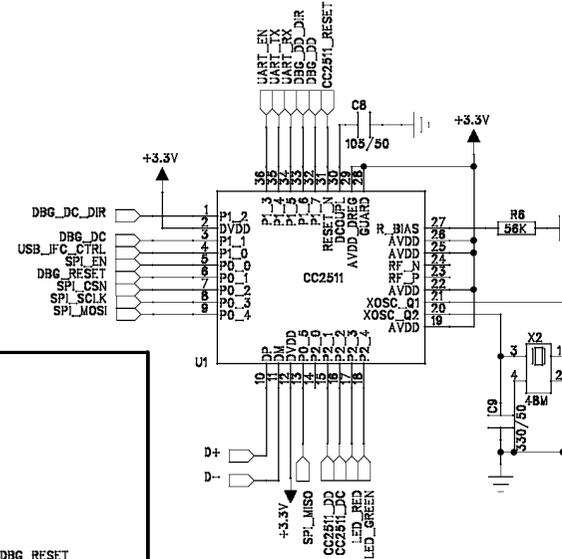
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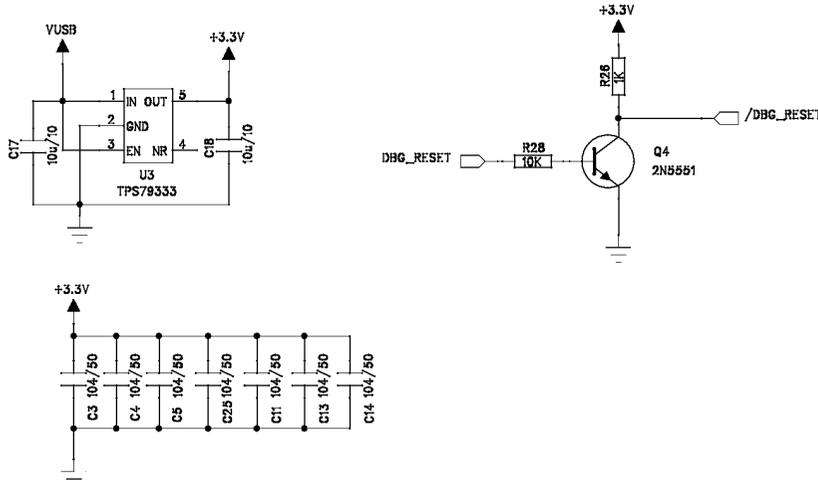
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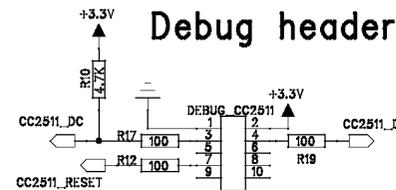
USB controller(CC2511)



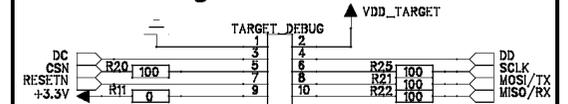
POWER



Debug header



Target Connector



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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

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.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

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.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
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EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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