

# WiMOD - iM880A

## Application Note AN010 / Version 0.5

Software development for iM880A



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## Document Information

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## Revision History

<b>Version</b>	<b>Description</b>
0.1	Preliminary version.
0.2	Description of new HW Version
0.3	Added boot loading description
0.4	Corrected hyperlink
0.5	Changed debug probe recommendation

## Aim of this Document

Aim of this document is to give a short description for software development with the iM880A. It also describes how to update the modules firmware by bootloader.

## Confidentiality Note

This document has to be treated confidentially. Its content must not be published, duplicated or passed to third parties without our express permission.

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# 1 Overview

Purpose of this application note is to describe the necessary aspects to develop your own firmware for the radio module iM880A from IMST GmbH. In chapter 4 is described how the firmware can be updated using to integrated bootloader.

## 2 Hardware Information

### 2.1 Schematic of the iM880A

The following figure shows the logical routing of the iM880A. It shows the pinout (left side) and all necessary information regarding software development.

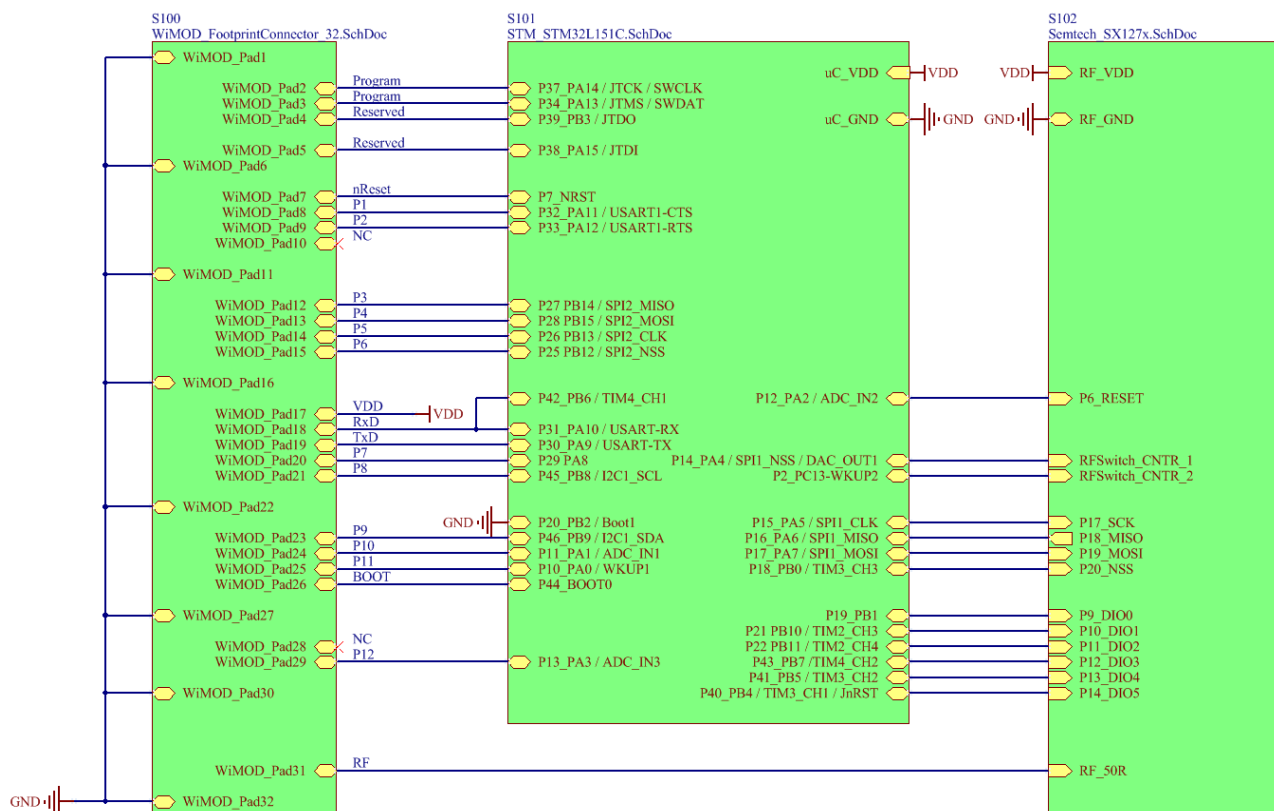


Figure 2-1: Logical routing of the iM880A

Main components of the iM880A are the STMicroelectronics microcontroller STM32L151Cx and the Semtech SX1272 transceiver. The microcontroller can be reprogrammed by using the integrated programming and debug interface described in chapter 2.3. The radio module is equipped with two external crystals. A 16MHz crystal is connected to  $\mu$ C pins 5 and 6 (OSC\_IN / OSC\_OUT) and a 32.768 kHz crystal is connected to  $\mu$ C pins 3 and 4 (OSC32\_IN / OSC32\_OUT).

## 2.2 WiMOD Demo Board

The WiMOD Demo Board provides several functional units like buttons, LEDs, a potentiometer, a buzzer and a temperature sensor. The module can easily be accessed via the on board UART to USB converter.

To develop software for the iM880A it is helpful to use the ST-Link/v2 debugger. The connection is described in chapter 2.3 of this document. Figure 2-2 gives an overview of the WiMOD Demo Board and its peripherals.

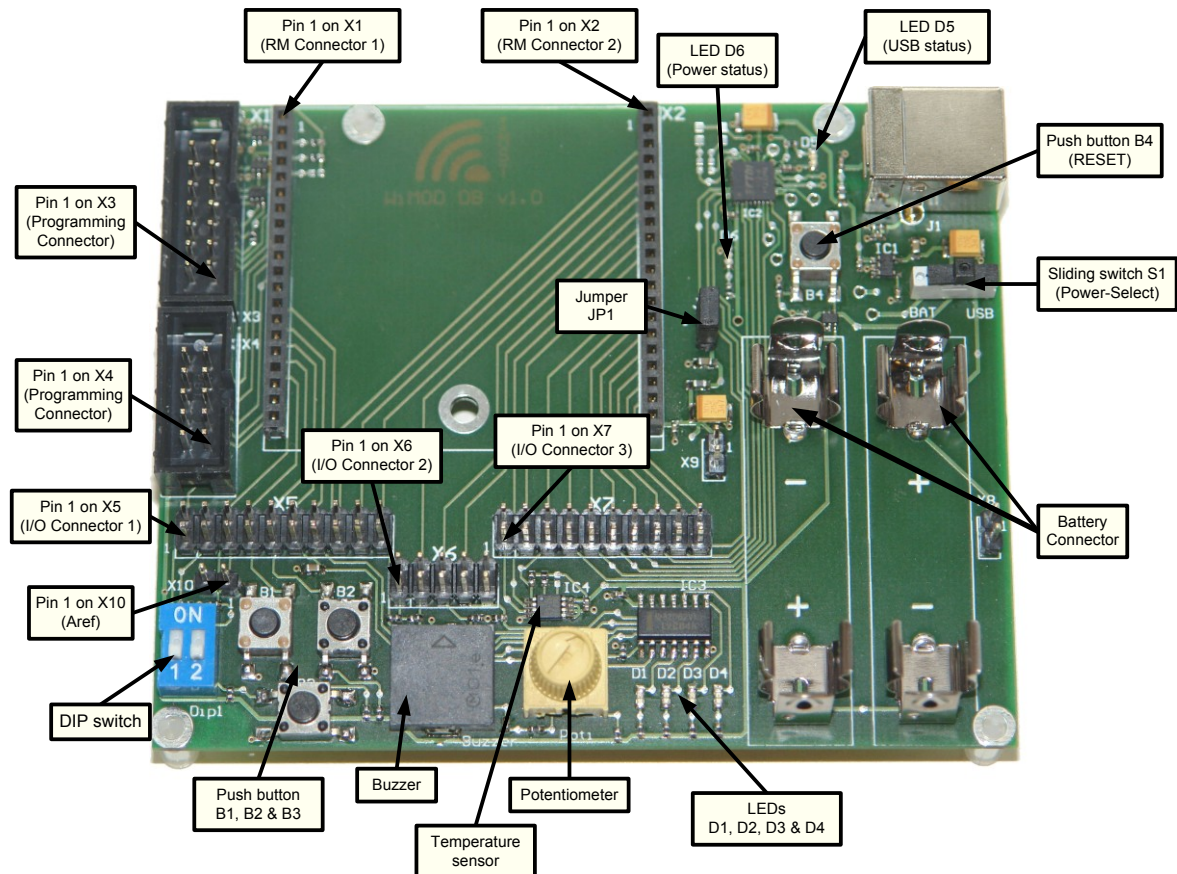


Figure 2-2: WiMOD Demo Board

When using the Demo Board with the iM880A, the module has to be soldered on its specific adapter board AB\_01 and plugged into X1 and X2. Now all necessary module pins are available on X4 (programming interface), X5, X6, and X7 of the Demo Board.

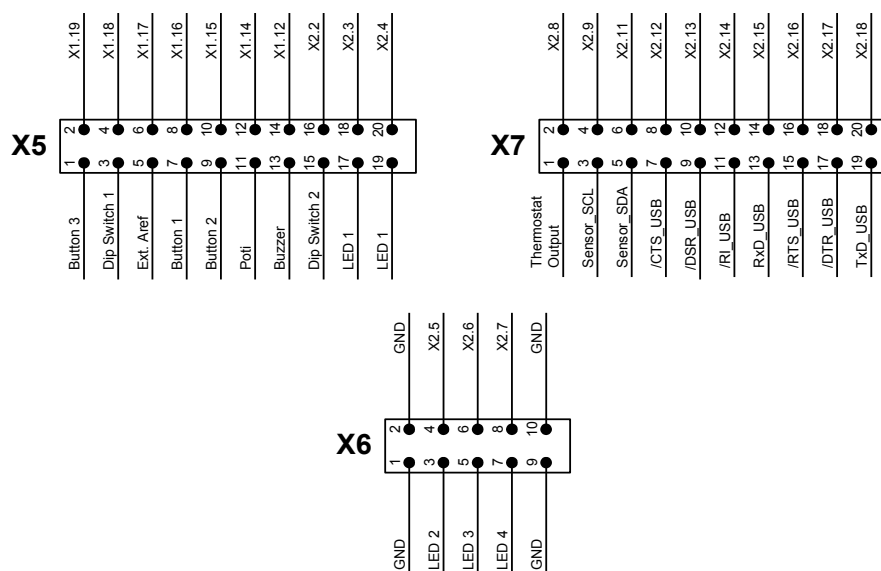


Figure 2-3: Graphical Pinout of the I/O connectors

Pin-Nr.	Connected to	Pin-Nr.	Connected to iM880A Pad Nr.
X5.1	Button 3	X5.2	14
X5.3	DIP Switch 1	X5.4	15
X5.5	Ext. ARef	X5.6	10
X5.7	Button 1	X5.8	13
X5.9	Button 2	X5.10	12
X5.11	Potentiometer	X5.12	9
X5.13	Buzzer	X5.14	8
X5.15	DIP Switch 2	X5.16	29
X5.17	LED 1	X5.18	29
X5.19	LED 1	X5.20	26
X6.1	GND	X6.2	GND
X6.3	LED 2	X6.4	25
X6.5	LED 3	X6.6	24
X6.7	LED 4	X6.8	20
X6.9	GND	X6.10	GND
X7.1	Thermostat Output	X7.2	28
X7.3	Temperature sensor (Sensor_SCL)	X7.4	21
X7.5	Temperature sensor (Sensor_SDA)	X7.6	23
X7.7	/CTS of the USB Controller	X7.8	-
X7.9	/DSR of the USB-Controller	X7.10	-
X7.11	/RI of the USB-Controller	X7.12	-
X7.13	RxD of the USB-Controller	X7.14	19
X7.15	/RTS of the USB-Controller	X7.16	-
X7.17	/DTR of the USB-Controller	X7.18	-
X7.19	TxD of the USB-Controller	X7.20	18

Table 2-1: Wiring of X5, X6 and X7 to the radio module

For more information please refer to the WiMOD Demo Board User Guide.

## 2.3 Programming Interface

The STM32L151Cx offers of a JTAG test interface (JTCK, JTMS, JTDI, and JTDO) which can be used for programming the On-chip flash and for accessing the On-chip Debug system. Table 2-2 lists the necessary pads of the iM880A which have to be connected to the programming device.

iM880A Pin #	Demo Board Pin row X4	Description
Pad 5	X4.1	JTDI
-	X4.2	GND
Pad 4	X4.3	JTDO
-	X4.4	VCC – Reference voltage for the programming device; must not be used to supply the demo board and the radio module
Pad 2	X4.5	JTCK
Pad 7	X4.6	/RESET (necessary for using the On-chip debug system)
-	X4.7	
-	X4.8	
Pad 3	X4.9	JTMS
-	X4.10	GND

Table 2-2: Programming and debug interface of the iM880A

With the WiMOD Starter Kit, the JTAG interface is reachable on pin row X4 of the WiMOD Demo Board. The development tool/programming device ST-Link/v2 STMicroelectronics must be connected to X4 using the wiring according to Figure 2-4:

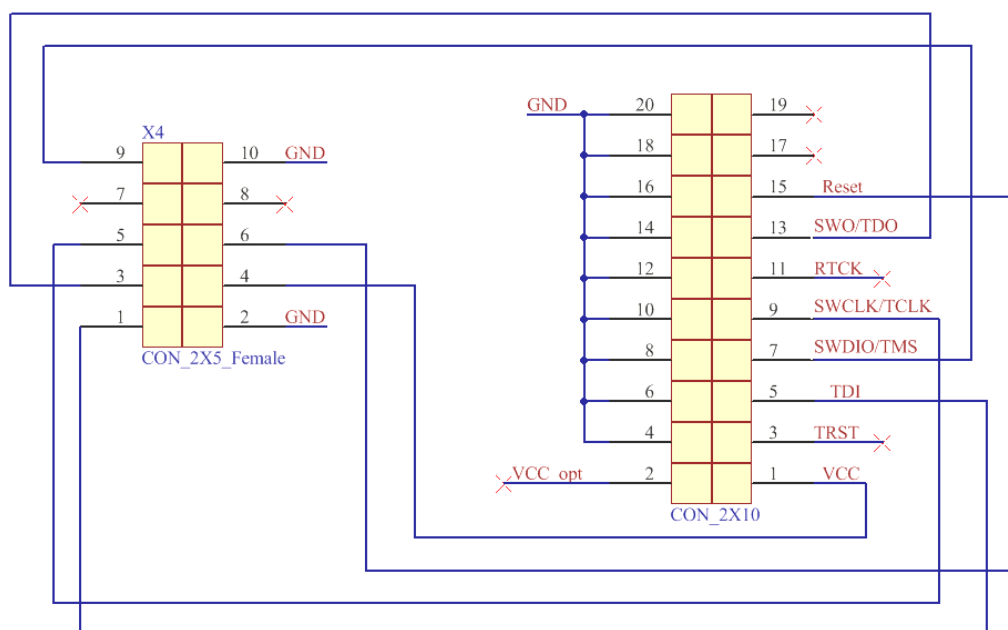


Figure 2-4: Pinout of X4 on the WiMOD Demo Board

## 3 Developing Software for the iM880A

### 3.1 Useful Tools

#### 3.1.1 IAR Embedded Workbench

*IAR Embedded Workbench for ARM* is an integrated development environment (IDE) with high optimizing C/C++ Compiler for ARM microcontrollers.

Link: <http://www.iar.com/en/Products/IAR-Embedded-Workbench/ARM/>, IAR Systems

#### 3.1.2 ST-Link/v2

The ST-LINK/V2 is a low-cost in-circuit debugger and programmer for the STM8 and STM32 microcontroller families. It can be used together *ST-Link Utility* to flash the modules microcontroller. It is also possible to be used with *IAR Embedded Workbench for ARM* for debugging.

Link: <http://www.st.com/stlinkv2>, STMicroelectronics

#### 3.1.3 J-Link Debug Probe

Furthermore many of the J-Link Debug Probes made by Segger can be used to program and debug the iM880A.

Link: <http://www.segger.com/jlink-debug-probes.html>, SEGGER Microcontroller GmbH & Co.KG



## 4 Firmware Update by Bootloader

The iM880A comes with an integrated bootloader to flash the device without using a programming adapter. With this bootloader HEX-Files can be loaded into the radio modules microcontroller via the UART interface. We recommend arranging an external access to the UART lines in your product design.

The bootloader uses the UART pins RxD and TxD and the bootloader pin (module pad 26) of the radio module to enter the bootloading mode.

### 4.1 Flash Loader Demonstrator Tool

- Download and install *Flash Loader Demonstrator* Tool from the STM website [www.st.com](http://www.st.com)
- Connect the iM880A device via USB Cable to your PC
- Select the right COM Port

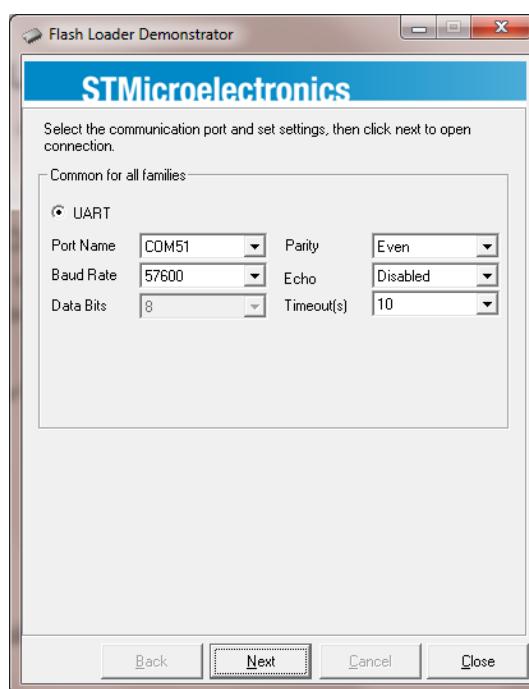


Figure 4-1: Flash Loader Demo, connection page

- Enter bootloader mode by connecting the iM880A bootloader pin to Vcc and power cycle the radio module (see Figure 4-2).

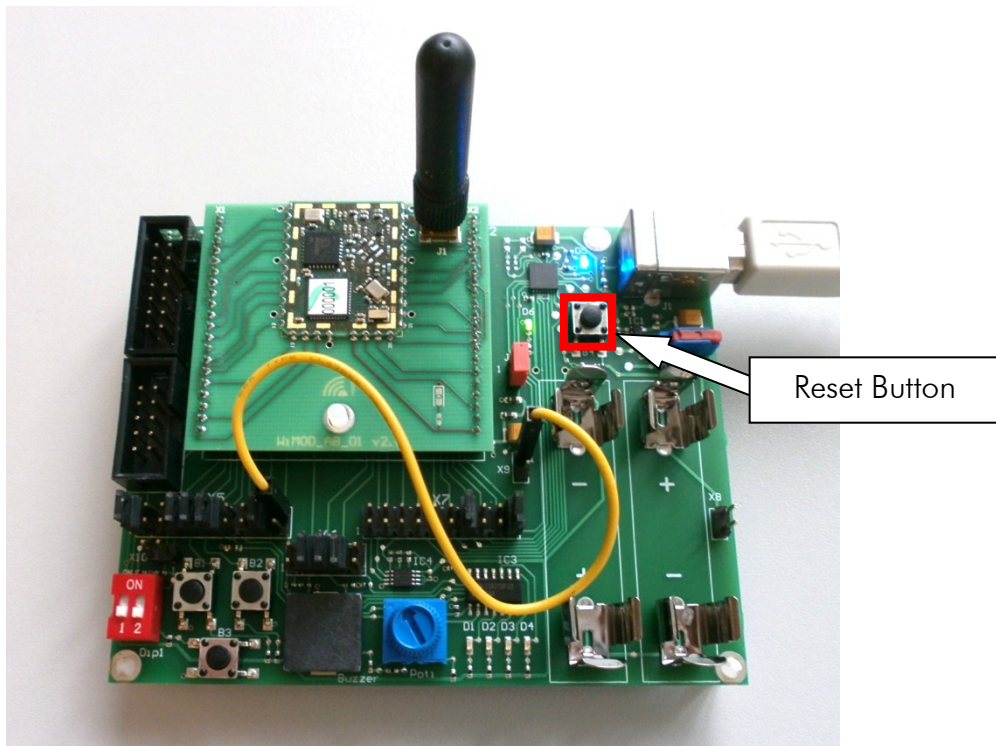


Figure 4-2: Establishing Bootloader Mode

On WiMOD Demo Board the iM880A bootloader pin1 is routed to connector X5.20. Connect X5.20 with X9.1 (Vcc) and press the reset button (B4) to power cycle the radio module.

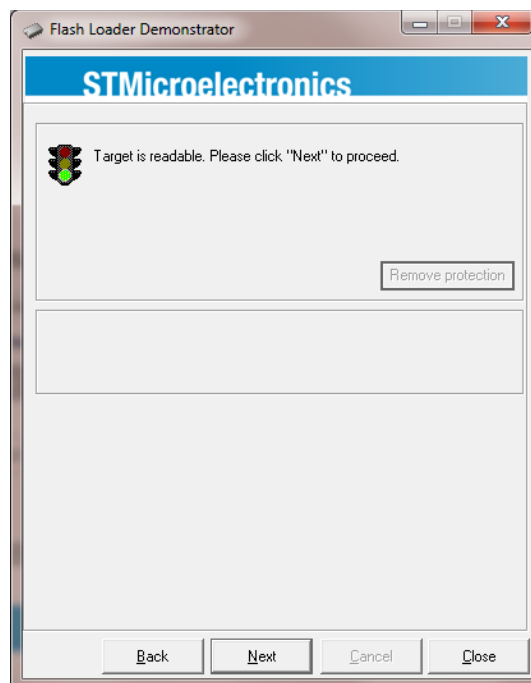


Figure 4-3: Flash Loader Demo, target connected

<sup>1</sup> If using iM880A without WiMOD Demo Board, connect module pad 26 with Vcc to enter bootloader mode.

- Press the *Next* button. If "Target is readable" appears, connection and bootloader mode could be established. Press the *Next* button to proceed.
- Select "STM32L\_Med-density-128K" as Target device and press *Next*.

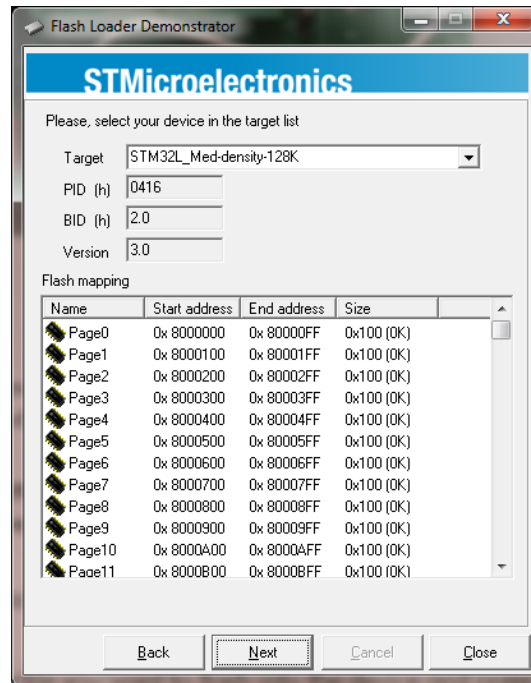


Figure 4-4: Flash Loader Demo, target selection

- Browse to the Hex file you want to flash into the device and press the *Next* button.

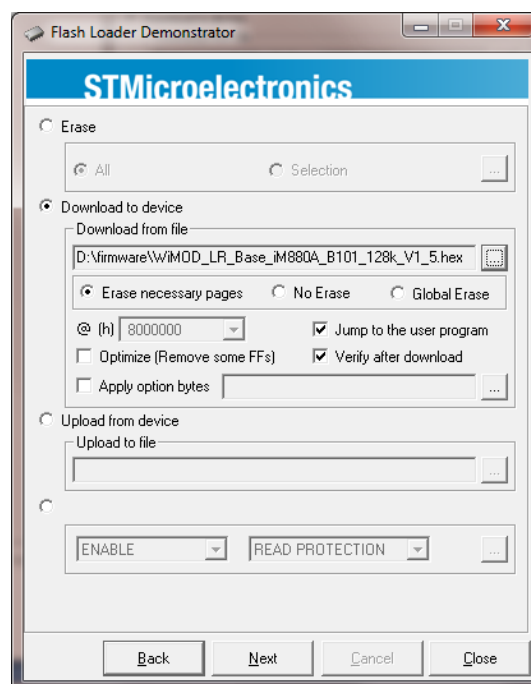


Figure 4-5: Flash Loader Demo, file selection

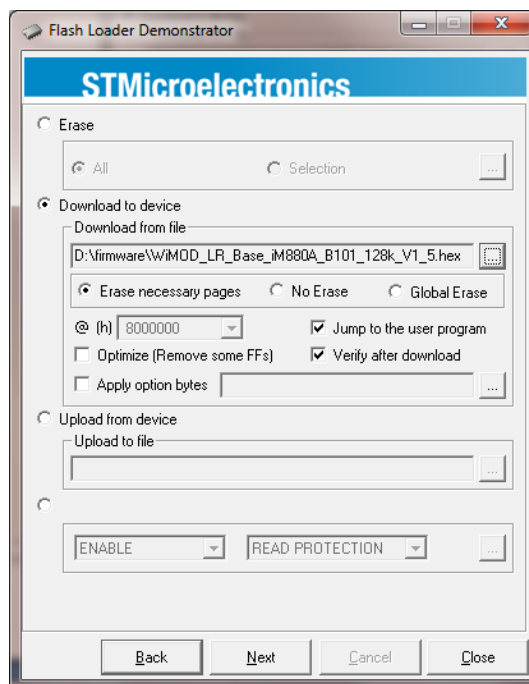


Figure 4-6: Flash Loader Demo, download progress

- After download has been completed, remove bootloader cable and press the reset button (B4) on WiMOD Demo board.

## 5 Appendix

### 5.1 List of Abbreviations

JTAG Joint Test Action Group

UART Universal Asynchronous Receiver Transmitter

USB Universal Serial Bus

VCP Virtual Com Port

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## 6 Regulatory Compliance Information

The use of radio frequencies is limited by national regulations. The radio module has been designed to comply with the European Union's R&TTE (Radio & Telecommunications Terminal Equipment) directive 1999/5/EC and can be used free of charge within the European Union. Nevertheless, restrictions in terms of maximum allowed RF power or duty cycle may apply.

The radio module has been designed to be embedded into other products (referred as "final products"). According to the R&TTE directive, the declaration of compliance with essential requirements of the R&TTE directive is within the responsibility of the manufacturer of the final product. A declaration of conformity for the radio module is available from IMST GmbH on request.

The applicable regulation requirements are subject to change. IMST GmbH does not take any responsibility for the correctness and accuracy of the aforementioned information. National laws and regulations, as well as their interpretation can vary with the country. In case of uncertainty, it is recommended to contact either IMST's accredited Test Center or to consult the local authorities of the relevant countries.

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