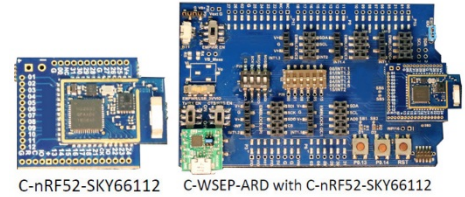


## Long Range BLE Boards

### C-NRF52-SKY66112

Nordic nRF52 BLE SoC with a Skyworks PA/LNA



C-nRF52-SKY66112

C-WSEP-ARD with C-nRF52-SKY66112

### Description:

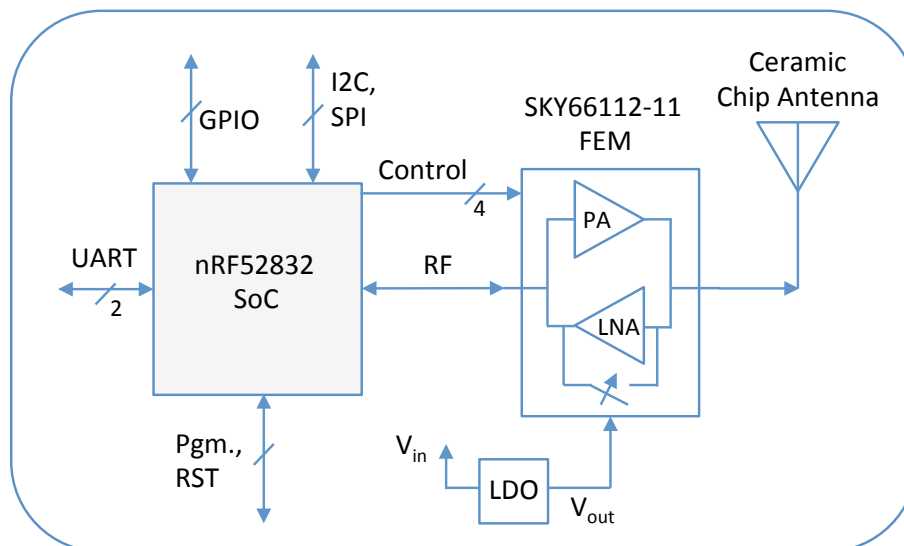
The C-nRF52-SKY66112 is a long-range Bluetooth Low Energy (BLE) compatible module that is based on the nRF52832, a RF SOC and SKY66112-11, a +21dBm PA/LNA RF front end. The nRF52 is a 'soft-core' module allowing the choice between BTLE, proprietary, or ANT RF applications, providing extreme flexibility for a broad range of unique wireless applications.

The C-nRF52-SKY66112 is designed for use with the C-WSEP-ARD (Wireless Sensor Evaluation Platform-Arduino). The C-WSEP-ARD connects directly to the nRF52 Development Kit (DK), enabling the use of the Segger J-LINK/JTAG on the nRF52 DK to program the C-nRF52-SKY66112. The C-WSEP-ARD may also be used as a stand-alone platform with the use of an external JTAG programmer. The C-WSEP-ARD allows for rapidly prototyping a wireless sensing application by making use of other sensor products that can be plugged into the respective headers.

For firmware development, Nordic nRF5x Software Development Kits are available directly from Nordic to support development of custom BLE, ANT, or Proprietary RF applications.

A block diagram of the C-NRF52-SKY66112 can be seen below. The major components are:

1. The nRF52832 Nordic System-on-Chip (SoC).
2. The Skyworks SKY66112-11 Front-End Module (FEM).
3. A low-dropout DC/DC converter to for a lower RF output power/current consumption mode
4. A ceramic chip antenna from Johansson Technologies



Communication is made with the device via a UART port, and has access to the various programming lines, serial port communications lines, and General Purpose Input/Output (GPIO) lines. Some GPIO lines can be used as analog inputs to the SoC, see the associated schematic and Nordic datasheet for details.

The SoC controls the functions of the SKY66112-11 FEM using 4 control lines. Additionally, a single control line is routed to the Low-Dropout (LDO) regulator, allowing for a choice of different supply voltages for the Radio Frequency Power Amplifier (PA) inside the module.

The LDO control line is connected between SoC GPIO line P0.28 and the VSET pin on the Texas Instruments TPS781DRV device. When asserted high, it will select a 2.2V output from the TPS781DRV. When asserted low, it will select a 3.0V output from the TPS781DRV. The output voltage is routed to Vcc2 on the SKY66112-11 FEM, and provides the “final stage” amplifier drain bias voltage. At 3.0V, the SKY66112-11 will provide a typical PA output power of +21 dBm. At 2.2V, the PA will provide approximately +18 dBm of output power. See the SKY66112-11 datasheet from Skyworks Semiconductor for more information.

## FEM Control

Four lines control the state of the Skyworks SKY66112-FEM. See the table below for more information. By manipulating these lines, the user has a wide range of control of the FEM, allowing for dynamic operation to maximize battery life while maintaining a stable RF connection.

Schematic Net Name	nRF SoC Pin	SKY66112-11 Pin	Description
P0.20/CTX	P0.20	CTX	Active high, used to set Transmit mode on
P0.19/CRX	P0.19	CRX	Active high, used to set Receive mode on
P0.06/CPS	P0.06	CPS	Active high, used to set TX or RX bypass mode on
P0.07/CHL	P0.07	CHL	Active high, used to set TX Power mode (Hi/Lo)

A more complete description of the functionality is provided in the following truth table:

### Mode Control Logic Table

Mode of Operation	CPS	CRX	CTX	CHL
Receive LNA Mode	0	1	0	x
Transmit High-Power Mode	0	0	1	1
Transmit Low-Power Mode	0	0	1	0
Receive Bypass Mode	1	1	0	x
Transmit Bypass Mode	1	0	1	x
Sleep Mode	x	0	0	x

Note: "x" = don't care

For a fully detailed description of the function of various control lines as well as modes of operation, please refer to the SKY66112-11 datasheet.

## Antenna

The chip antenna included on the PCB is from Johansson Technologies, and is part number: 2450AT43B100E. The antenna dimensions are approximately 7mm x 2mm x 2mm high.

The elements of C21, L3, and C23 are in place to provide some filtering of transmit spurs that may be generated by the Nordic device. The Skyworks datasheet has these elements in place for possible impedance matching or filtering requirements, simply to “reserve” the placement pads for the values, which must be determined experimentally. It is recommended that these components be retained.

The elements L7, L4, and L6 provide a matching network between the SKY66112 and the included antenna. Any changes in PCB layout or stack up may require tuning of these values. Using a different antenna will almost certainly require new matching components as well. So, it is recommended that these circuit elements be retained, to allow for various tuning values and combinations of elements to be used.

## Test Software

The unit ships with a very basic set of RF test software installed. This software uses the UART to communicate, with the following settings:

Baud Rate: 38400  
Data: 8 bit  
Parity: none  
Stop: 1 bit  
Flow control: none

*Note that if the on-board software is changed, these UART settings may also change, as they are governed by the application software running on the SoC.*

To get a list of available functions, type an “h” command followed by <enter> in the UART communications terminal window. The on-board software will provide a list of supported commands. When using this software to Transmit, it will control the SKY66112 and place it in “high power” mode. Similarly, when using this software to configure for receive mode, the SoC will place the SKY66112 into RX mode with the LNA enabled.

It is fully expected that the user will replace this software to provide the necessary functionality for the communication personality that they are implementing, whether it be BLE, ANT, or a proprietary radio format. The user must insure that the system software utilizes the FEM module fully, by controlling the four signal lines as outlined above.

## Key Features:

- Up to +21dBm RF output power
- Extended range (up to 400m)
- 1.7-3.6V operation - designed to make use of internal DC/DC for maximum efficiency
- Extended Temp XTAL (-40 to 125°C)
- 100% compatible with the nRF52 DK for use with J-LINK on-board nRF52 DK
- 28 User GPIO (8 Analog inputs) along with serial wire debug pins all mapped out on module
- On-board chip antenna
- PA/LNA has several configurable options including 1uA SLEEP between Tx/Rx
- Available for use with C-WSEP-ARD Wireless Sensor Evaluation Platform

## Reference Materials:

### C-nRF52-SKY66112 Buy Now Product Page:

<https://www.cdiweb.com/ProductDetail/CNRF52SKY66112-Embedded-Masters/602122/>

### nRF52832 Product Page:

<http://www.nordicsemi.com/eng/Products/Bluetooth-Smart-Bluetooth-low-energy/nRF52832>

### nRF52 DK:

<http://www.nordicsemi.com/eng/Products/Bluetooth-Smart-Bluetooth-low-energy/nRF52-DK>

### nRF5 SDK:

[http://developer.nordicsemi.com/nRF5\\_SDK/](http://developer.nordicsemi.com/nRF5_SDK/)

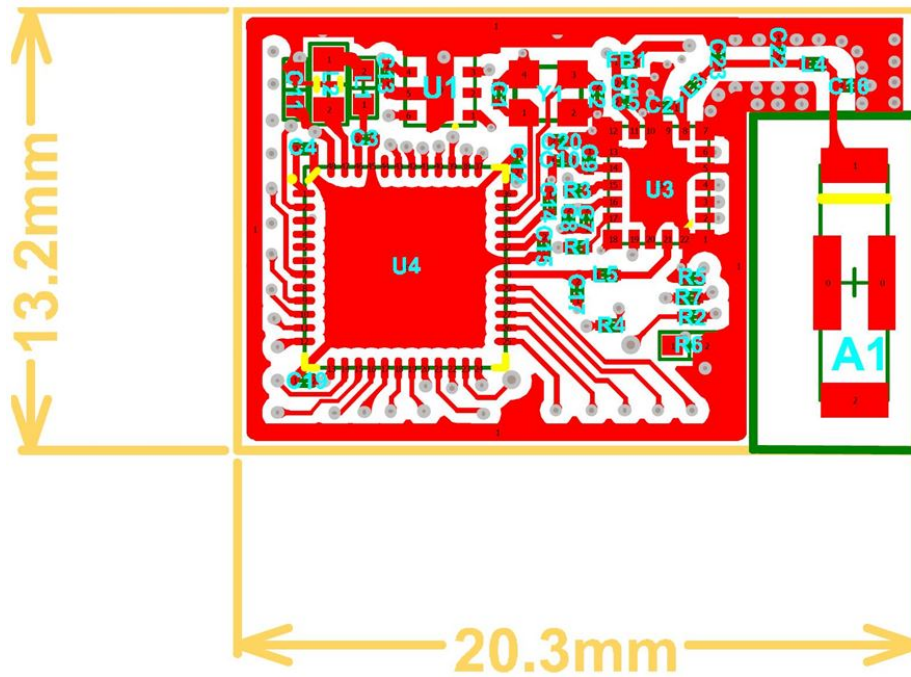
### IAR (IDE/Compiler):

<http://netstorage.iar.com/SuppDB/Protected/PRODUPD/010840/EWARM-CD-7503-10751.exe>

### KEIL(IDE/Compiler):

<http://www2.keil.com/mdk5>

C-nRF52-SKY66112 PCB:



## Wireless Sensor Evaluation Platform

### C-WSEP-ARD

The C-WSEP-ARD (Wireless Sensor Evaluation Platform) is a board that allows for other products to be plugged into the WSEP allowing rapid prototyping of a sensor/wireless sensor system.

Image of C-WSEP-ARD:

