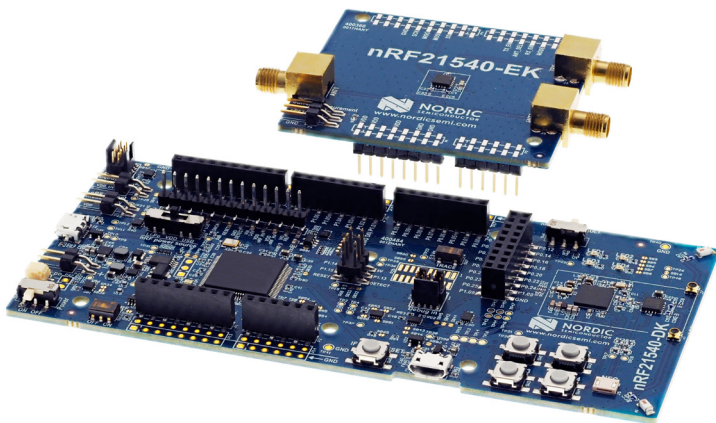


# nRF21540 DB

Development bundle (DB) including the nRF21540 RF front-end module (FEM) for 2.4 GHz range extension.



## nRF21540 DB

The [nRF21540 DB](#) consists of the nRF21540 development kit (DK) and the nRF21540 evaluation kit (EK). The nRF21540 DK is the perfect tool to develop products that require the range extension capabilities or link budget improvements provided by the nRF21540 RF front-end module (FEM). The nRF21540 EK can connect to lab equipment via SMA connectors to monitor the RF FEM's performance.

## nRF21540 DK

The nRF21540 DK contains the nRF21540 RF FEM and the nRF52840 SoC and has two antenna ports with chip antennas and additional SWF connectors for direct RF measurements. The dual antennas can be used in an antenna diversity scenario with, for instance, Thread or Zigbee (802.15.4) protocols to reduce multipath fading effects. The RF FEM is connected to and controlled by the nRF52840 advanced multi-protocol SoC that supports all Bluetooth 5.2 features relating to Bluetooth LE, mesh networking protocols such as Bluetooth mesh, Thread and Zigbee, as well as 2.4 GHz proprietary protocols.

Sharing many similarities with the [nRF52840 DK](#), the nRF21540 DK contains an onboard Segger J-LINK debugger accessible through USB, 4 user-programmable LEDs and 4 buttons, an NFC-A tag antenna connector and current measurement pins. It is the perfect tool to enable real application performance testing with the extended range offered by the nRF21540.

## nRF21540 EK

On the nRF21540 EK, the RF FEM connects to lab equipment, nRF52 or nRF53 Series DKs or other devices via an SMA connector. The nRF21540's TX gain control, antenna switching, and modes are controlled via GPIO or SPI or a combination of both, accessible through the Arduino Uno Rev3 compatible headers. The shield also features two additional SMA connectors connected to the dual antenna ports from the RF FEM, to monitor the performance of the RF FEM using any equipment desired.

## Key features: nRF21540 DK

- Versatile development kit for the nRF21540 RF FEM
- 2 × 2.4 GHz antennas for antenna diversity
- 2 × SWF RF ports for direct RF measurements
- Segger J-Link OB programmer/debugger
- Power and program/debug via USB interface
- Direct USB interface to nRF52840 SoC
- NFC-A tag antenna connector
- Arduino Uno Rev3 compatible
- User-programmable buttons (4) and LEDs (4)
- 1.7-5.5 V supply from USB, external Li-Po battery or external power source
- Pins for measuring power consumption
- nRF52840 SoC w/ Bluetooth Low Energy (LE), Thread and Zigbee (802.15.4) and 2.4 GHz proprietary protocol support
  - Arm® Cortex™-M4 with floating point unit
  - Arm® CryptoCell-310 cryptographic accelerator

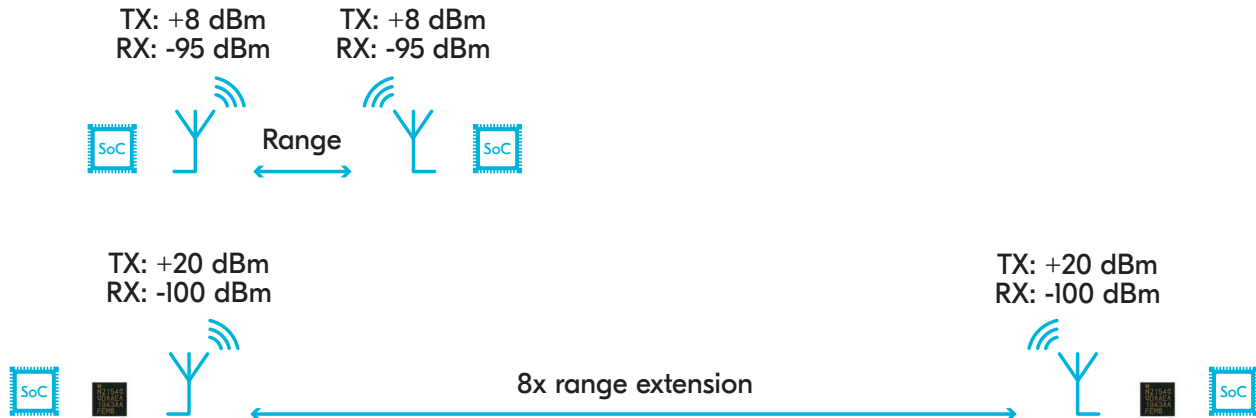
## Key features: nRF21540 EK

- Versatile evaluation kit for the nRF21540 RF FEM that can be used with nRF52 and nRF53 Series DKs, as well as other devices
- ANT1 and ANT2 ports (SMA) for antennas or lab equipment
- TRX port (SMA) for connecting radio or lab equipment
- Pins for measuring power consumption
- Arduino Uno Rev3 compatible

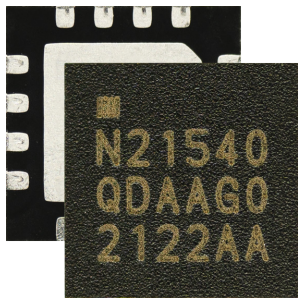
## Key features: nRF21540 FEM

- Adjustable output power in small increments up to +21 dBm
- 13 dB RX gain, with 2.7 dB noise figure
- Supports Bluetooth LE, Bluetooth mesh, Thread and Zigbee (802.15.4) and 2.4 GHz proprietary protocols
- TX gain control via I/Os, SPI or a combination
- 105 °C extended operating temperature
- When combined with an nRF52 or nRF53 Series SoC:
  - Between 6.3-10× range extension
  - -100 dBm RX sensitivity (Bluetooth LE, 1 Mbps)
- nRF21540 RF FEM + nRF52840 SoC
  - 18 dB improved link budget, 8× theoretical range extension

Figure of link budget improvement



Link budget improvement for the nRF21540-DK compared to the nRF52840-DK.



#### nRF21540 RF FEM

The [nRF21540 RF FEM](#) contains a power amplifier (PA) and low noise amplifier (LNA) for increasing the link budget, improving connection robustness and/or extending range of Nordic's nRF52 and nRF53 Series SoCs and other devices. The RF FEM requires a minimal number of extra components to work with our

short-range wireless products. The power amplifier increases the TX gain, which influences the total TX output power and the LNA increases the RX sensitivity.

The nRF21540's 13 dB RX gain, low noise figure (2.7 dB) and up to +21 dBm TX output power ensure a superior link budget and between 6.3-10× longer range when paired with an nRF52 or nRF53 Series SoC. When combined with an nRF52840 SoC running Bluetooth Low Energy (LE) at 1 Mbps, the RX sensitivity is improved by 5 dB, from -95 dBm to -100 dBm. Adding the TX gain improvements of up to 13 dB, the total link budget improvement is up to 18 dB. This equals an 8× theoretical range increase. For some nRF52 and nRF53 Series devices with less than +8 dBm TX power on chip, the improvements are even more significant (up to 10× longer range).

#### Dynamically Adjustable TX Output Power

The nRF21540's TX power is dynamically adjustable and the output power can be set in small increments. This ensures that designs can run with output power within 1 dBm of the allowable range across all regions and operating conditions. The output power can be set either via GPIOs or SPI. GPIOs lets you adjust between two pre-programmed TX gain values, while SPI allows for smaller increment adjustments of the TX gain. In demanding environments, or close to the range limits, it can be more energy efficient to deploy with the nRF21540 RF FEM than having to continuously retransmit packets.

#### nRF Connect SDK support

The [nRF Connect SDK](#) is the software development kit for the nRF21540 RF FEM, and it has board support for the nRF21540 DB. It also supports development on our nRF52, nRF53 and nRF91 Series. For short-range, it supports development of Bluetooth LE, Bluetooth mesh and Thread and Zigbee applications. nRF Connect SDK integrates the Zephyr RTOS, protocol stacks, samples, hardware drivers and much more.

While the nRF21540 RF FEM can be used with other devices, the ease of use with Nordic SoCs is further enhanced with driver support in nRF Connect SDK and the nRF5 SDK for Thread and Zigbee. The nRF Connect SDK has support for both the nRF21540 DK and nRF21540 EK via the nrfxlib Multi-Protocol Service Layer (MPSL) library. The library provides support for the GPIO switching mode and allows concurrent operation of Bluetooth LE together with one of our supported mesh protocols (i.e. Bluetooth mesh, Thread or Zigbee).

#### Applications

- Asset tracking and RTLS
- Industrial
- Professional Lighting
- Toys
- Smart Home
- Audio

#### Related Products

<a href="#">nRF21540 RF FEM</a>	RF Front end module (FEM)
<a href="#">nRF5340 DK</a>	Development kit for the nRF5340 SoC
<a href="#">nRF52 Series</a>	nRF52840, nRF52833, nRF52832, nRF52820, nRF52811, nRF52810, nRF52805 SoCs
<a href="#">nRF Connect SDK</a>	Software development kit for the nRF21540 DB

#### Order Information

<a href="#">nRF21540-DB</a>	Development bundle for the nRF21540 RF FEM
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