nRF21540

RF front end module for 2.4 GHz wireless range extension

Overview

The nRF21540 is an RF front end module (FEM) that improves range and connection robustness for Nordic Semiconductor's short-range wireless portfolio. As a complementary device, the nRF21540 is a "plug and play" range extender that can be used with the nRF52 and nRF53 Series advanced multiprotocol wireless SoCs with a minimal amount of external components required.

The nRF21540's +13 dB RX gain and low noise figure (2.5 dB), coupled with up to +21 dBm TX output power ensure a superior link budget for up to 16x longer range. When combined with an nRF52840 SoC running Bluetooth Low Energy at 1 Mbps, for example, the nRF21540 improves the RX sensitivity by 5 dBm to -100 dBm. Coupled with the increased output power, the connection link budget is raised by 18 dBm. For nRF52 and nRF53 Series devices with less than +8 dBm TX power on-chip, the improvements are even larger, reaching 16x longer range.

The nRF21540's TX power is dynamically adjustable and 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 RF FEM is a valuable addition for all applications that may require increased range or robust coverage. In demanding environments, or close to the range limit, it can be more energy efficient to deploy with the nRF21540 than taking a hit on throughput due to continuous retransmissions. The device can also operate across a -40°C to +105°C temperature range, allowing it to complement Nordic's high temperature qualified nRF52833 and nRF5340 SoCs in industrial applications such as professional lighting. Other example applications are asset tracking, remote controlled toys, audio and smart home use cases.

While the device can be used with other radios, the ease of use with Nordic SoCs is further enhanced as driver support will be rolled out as part of future releases of Nordic's nRF5 SDK, nRF5 SDK for Thread and Zigbee, and the nRF Connect SDK.

KEY FEATURES

- Supports
  - Bluetooth® Low Energy (incl. Bluetooth mesh)
  - Thread and Zigbee (802.15.4)
  - Proprietary 2.4 GHz
- Adjustable output power in small increments up to +21 dBm
- +13 dB receive gain with 2.5 dB noise figure
- Two antenna ports for antenna diversity
- Control interface via I/Os, SPI, or a combination
- -40°C to +105°C operating temperature range
- 1.7 V to 3.6 V input supply range
- 4 × 4 mm QFN16 package
- When combined with an nRF52 or nRF53 Series SoC:
  - Up to 16x range increase
  - -100 dBm RX sensitivity (Bluetooth LE, 1 Mbps)
- Current consumption:
  - TX tuned to +20 dBm: 115 mA
  - RX: 4.1 mA
  - Power down mode: 30 nA

EXAMPLE APPLICATIONS

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

Complementing the release of the nRF21540, Nordic offers development kits that enable measuring the RF FEM performance using lab equipment, as well as evaluating real application performance combined with an nRF52840 SoC.

0dBm   0dBm

Range

+20dBm   +20dBm

16x range extension
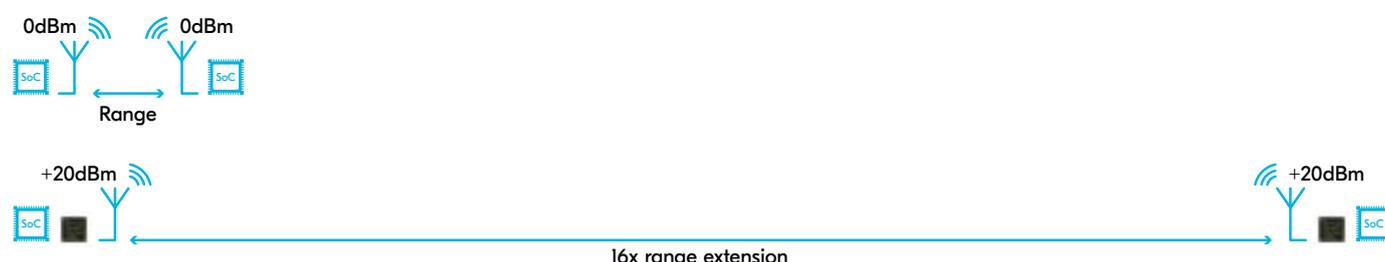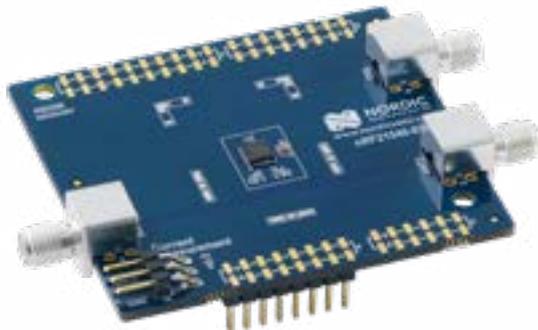
nRF21540 Development Kit

The nRF21540 development kit contains the nRF21540 RF FEM and has two antennas with SWF ports 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 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 development kit contains an onboard Segger J-LINK debugger accessible through USB, user-programmable LEDs and buttons, an NFC 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 Evaluation Kit

On the nRF21540 evaluation kit, the RF FEM connects to lab equipment or radio via an SMA connector. The nRF21540's 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 hooked to the dual antenna ports from the RF FEM, to monitor the performance of the RF FEM using any equipment desired.

KEY FEATURES

nRF21540 Development Kit

- nRF21540 RF front end module
- 2 × 2.4 GHz antennas for antenna diversity
- 2 × SWF RF ports for direct RF measurements
- nRF52840 SoC w/ Bluetooth LE, 802.15.4, 2.4 GHz protocol support
  - Arm® Cortex™-M4 with floating point unit
  - Arm® CryptoCell CC310 cryptographic accelerator
- Segger J-Link OB programming/debugging supported
- Pins for current consumption measurements
- USB interface direct to nRF52840 SoC
- USB interface to power and program/debug
- NFC antenna connector
- Arduino Uno Rev3 compatible
- 4 × user-programmable buttons and LEDs
- Coin-cell battery holder

nRF21540 Evaluation Shield

- nRF21540 RF front end module
- ANT1 and ANT2 ports (SMA) for antennas or lab equipment
- TRX port (SMA) for connecting radio or lab equipment
- Pins for current measurement
- Arduino Uno Rev3 form factor

For more information please visit:
www.nordicsemi.com/Products/Low-power-short-range-wireless/nRF21540

RELATED PRODUCTS

nRF5340 SoC	SoC supporting Bluetooth 5.1, Bluetooth mesh, NFC, Thread & Zigbee
nRF52 Series	nRF52840, nRF52833, nRF52832, nRF52811, nRF52810 SoCs
Power Profiler Kit	Easy-to-use power measurement tool

ORDER INFORMATION

Limited sampling	Get in touch through our sales organization

WORLD WIDE OFFICE LOCATIONS

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For more information
Visit **nordicsemi.com** for the complete product specification about this and any other wireless ULP products.

About Nordic Semiconductor
Nordic Semiconductor is a fabless semiconductor company specializing in ULP short-range wireless communication. Nordic is a public company listed on the Norwegian stock exchange.

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