

Datasheet

BL5340PA Series

Version 0.1

REVISION HISTORY

| Version | Date | Notes | Contributor(s) | Approver |
|---------|-------------|-----------------|----------------------------|---------------|
| 0.1 | 19 Jan 2023 | Initial Release | Raj Khatri, Dave Drogowski | Jonathan Kaye |
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1 OVERVIEW AND KEY FEATURES

The BL5340PA series of robust modules are based on the Nordic nRF5340 SoC. It directly targets the highest performance with the lowest power budget, whilst incorporating the Nordic nRF21540 PA/LNA for higher TX Power applications. Featuring Bluetooth 5.3 including Isochronous Channels and LE Audio, the BL5340PA supports next generation Bluetooth audio for stereo streaming and broadcast audio.



The dual core Arm® Cortex M33 microcontrollers enable you to run a low power core focused purely on wireless connectivity, with a second higher performance core targeted for the end application itself. This further extends the multi-protocol capabilities of the product: Bluetooth LE, 802.15.4 (Thread / Zigbee) and NFC. It's further enhanced with an ARM CryptoCell-312 including trusted execution, root-of-trust and secure key storage security features.

The BL5340PA series brings out all nRF5340 hardware features and capabilities including USB access, up to +18.5 dBm transmit power, from 3.0V to 3.6V supply considerations, and a true industrial operating range of -40 to 105°C. Multiple regulatory certifications enable faster time to market and reduced development risk completes Laird Connectivity's simplification of your next multi-protocol wireless design!

Note: BL5340PA hardware provides all functionality of the nRF5340 chipset used in the module design. This is a hardware datasheet only – it does not cover the software aspects of the BL5340PA. This is to acknowledge that information in this datasheet is referenced from the nRF5340 datasheet – consult for details:
https://infocenter.nordicsemi.com/topic/ps_nrf5340/keyfeatures_html5.html?cp=3_0_0

1.1 Features and Benefits

- Based on Nordic Semiconductor nRF5340, nRF21540 silicon
- Bluetooth v5.3 – Single mode
- NFC
- IEEE 802.15.4-2006 (Thread or Zigbee) radio support
- External or internal antennas
- Programmable Tx power +18.5dBm to -20 dBm
Note: See section 6.2.4 for actual radio regulator RF TX power limit allowed for each regulatory region.
- Rx sensitivity -103 dBm (1 Mbps), - 108.5 dBm (125 kbps)
- Ultra-low power consumption
- Tx – 99.7 mA peak (at +18.5 dBm, DCDC on)
(See Note 1 in the *Power Consumption* section)
- Rx: 11.6 mA peak (DCDC on)
(See Note 1 in the *Power Consumption* section)
- System ON Idle – 3.1 uA typical
- System OFF – 0.9 uA – (See Note 4 in the *Power Consumption* section)
- UART, GPIO, ADC, PWM, timers, I2C, QSPI, SPI, I2S, PDM, and USB interfaces
- FCC, ISED and RCM certified
- Full Bluetooth Declaration ID
- Other regulatory certifications on request
- No external components required
- Industrial temperature range (-40° C to +105° C)

1.2 Application Areas

- Medical devices
- IoT Sensors
- Access Control
- Health & Wellness devices
- Location awareness
- Factory automation

2 SPECIFICATION

2.1 Specification Summary

| Categories/Feature | Implementation | |
|---|---|--|
| Wireless Specification | | |
| Bluetooth® | Bluetooth 5.3 – Single mode <ul style="list-style-type: none"> ▪ Isochronous Channels (LE Audio) – BT 5.2 ▪ EATT – BT5.2 ▪ LE Power Control – BT 5.2 ▪ 4x Range (CODED PHY support) – BT 5.1 ▪ 2x Speed (2M PHY support) – BT 5.1 ▪ LE Advertising Extension – BT 5.1 ▪ Diffie-Hellman based pairing (LE Secure Connections) – BT 4.2 ▪ Data Packet Length Extension – BT 4.2 ▪ Link Layer Privacy (LE Privacy 1.2) – BT 4.2 ▪ Concurrent master, slave ▪ BLE Mesh capabilities ▪ Bluetooth direction finding | |
| IEEE 802.15.4-2006 PHY | 2405–2480 MHz IEEE 802.15.5-2006 radio transceiver, implementing IEEE 802.15.5-2006 compliant <ul style="list-style-type: none"> ▪ 250kbps,2450MHz, O-QPSK PHY ▪ Channels 11-26. Channel 11 2405MHz and CH26 2480MHz. ▪ Clear channel assessment (CCA) ▪ Energy detection (ED) scan ▪ CRC generation | |
| Nordic proprietary 1Mbps and 2Mbps modes radio (<i>not currently certified by Laird Connectivity</i>) | 2402–2480 MHz Nordic proprietary 1Mbps and 2Mbps modes radio transceiver <ul style="list-style-type: none"> ▪ 1Mbps nRF proprietary mode (ideal transmitter) ▪ 2Mbps nRF proprietary mode (ideal transmitter) | |
| Frequency | 2.402 - 2.480 GHz for BLE (CH0 to CH39) 2.405 - 2.480 GHz for IEEE 802.15.4-2006 PHY (CH11 to CH26) | |
| Raw Data Rates | 1 Mbps BLE (over-the-air) 2 Mbps BLE (over-the-air) 125 kbps BLE (over-the-air) 500 kbps BLE (over-the-air) 250 kbps IEEE 802.15.4 802.15.4-2006 (over-the-air) Nordic proprietary 1Mbps and 2Mbps modes (over-the-air) | |
| Maximum Transmit Power Setting <i>(See Note 1 in the Module Specification Notes)</i> | +18.5dBm (BLE), +21.0dBm (IEEE 802.15.4-2006) | Conducted 453-00068 (Integrated antenna) |
| | +16.9dBm (BLE), +21.0dBm (IEEE 802.15.4-2006) | Conducted 453-00076 (External antenna) |
| | See section 6.2.4 for actual radio regulator RF TX power limit allowed for each regulatory region | |
| Minimum Transmit Power Setting | -40dBm (nRF5340) | |
| Receive Sensitivity (≤37byte packet for BLE) | BLE 1 Mbps (BER=1E-3) | -103 dBm typical |

| Categories/Feature | Implementation |
|-------------------------|--|
| | BLE 2 Mbps -100 dBm typical |
| | BLE 125 kbps -108.5 dBm typical |
| | BLE 500 kbps -106 dBm typical |
| | IEEE 802.15.4-2006 250kbps -107 dBm typical |
| Link Budget (conducted) | 121.5 dB @ BLE 1 Mbps (TX power used is 18.5dBm) |
| | 127.0 dB @ BLE 125 kbps (TX power used is 18.5dBm) |

| NFC | |
|-------------------------------|---|
| | <p>Based on NFC forum specification</p> <ul style="list-style-type: none"> 13.56 MHz Data rate 106 kbps NFC Type2 and Type 4 emulation <p>Modes of Operation:</p> <ul style="list-style-type: none"> Disable Sense Activated <p>Use Cases:</p> <ul style="list-style-type: none"> Touch-to-Pair with NFC NFC enabled Out-of-Band Pairing |
| NFC-A Listen mode compliant | |
| System Wake-On-Field function | Proximity Detection |

| Host Interfaces and Peripherals | Applications Core (High Performance) | Network Core (ultra-low power) |
|---------------------------------|---|---|
| Total | 40 x multifunction I/O lines | |
| Two co-processors | Arm Cortex-M33 with DSP, FPU, TrustZone support. 1024kB Flash 512kB RAM 8kB 2-way associative cache 128 and 64MHz clock Uses voltage and clock frequency scaling | Arm Cortex-M33 256kB Flash 64kB RAM 2kB instruction cache 64MHz clock |
| UART | 4 x UART (with CTS, RTS) | 1 x UART (with CTS, RTS) |
| USB | 1 x USB 2.0 FS (Full Speed, 12Mbps) | - |
| GPIO | Up to 40 28 x GPIOs on P0.00-P0.03, P0.05 to P0.31 11 x GPIOs on P1.02=P1.03, P1.06 to P1.15 With configurable I/O direction, O/P drive strength (standard 0.5 mA or high 3mA/5 mA), Pull-up /pull-down Input buffer disconnect | |

| Host Interfaces and Peripherals | Applications Core (High Performance) | Network Core (ultra-low power) |
|---------------------------------|--|--|
| ADC (200kbps) | Seven 8/10/12-bit channels on AIN0-AIN7 or VDD or VDDH/5 14-bit resolution with oversampling AIN0-AIN7 Configurable reference internal reference 0.6V or external reference VDD/4 Configurable pre-scaling of 4, 2, 1, 1/2, 1/3, 1/4, 1/5 1/6 Configurable acquisition time 3uS, 5uS, 10uS (default), 15uS, 20uS, 40uS. One-shot mode or Burst mode Scan mode for multiple channels Single ended or Differential or not connected | - |
| COMP | 1 x COMP (comparator) | - |
| LPCOMP | 1 x LPCOMP (low power comparator) | - |
| High-Speed SPI | 1 x High-speed SPI (32Mbps, SPIM4) master or slave with Easy DMA on dedicated pins | - |
| SPI | 4 x SPI (up to 16Mbps) master or slave with Easy DMA Slave is up to 8Mbps | 1 x SPI master or slave with Easy DMA Slave is up to 8Mbps |
| High-Speed TWI (I2C) | 1 x High-speed TWI (1Mbps) master or slave with Easy DMA on dedicated pins | 1 x High-speed TWI (1Mbps) master or slave with Easy DMA on dedicated pins |
| TWI (I2C) | 3 x TWI (up to 400kps, 200kbps, 100kbps) master or slave with Easy DMA | 1 x TWI (up to 400kps, 200kbps, 100kbps) master or slave with Easy DMA |
| QSPI | 1 x QSPI interface (6 to 96MHz configurable clock frequency) for communicating with external flash memory. XIP (Execution in Place) capability. | - |
| PWM | 4 x PWM (pulse width modulation) units with Easy DMA | - |
| QDEC | 2 x QDEC (Quadrature decoder) | - |
| I2S | 1 x I2S (Inter-IC sound interface) | - |
| PDM | 1 x PDM (Pulse code modulation interface) for digital microphones | - |
| TIMER | 3 x Timer (32bit) | 3 x Timer (32bit) |
| RTC | 2 x RTC (24bit) | 2 x RTC |
| WDT | 2 x WDT (Watchdog timer) | 2 x WDT (Watchdog timer) |
| EGU | 6 x EGU (Event generator unit) | 1 x EGU (Event generator unit) |
| RNG | - | 1 x RNG (random number generator) |
| TEMP | - | 1 x Temperature sensor Temperature range equal to operating temperature range |
| ECB | - | 1 x ECB (AES electronic codebook mode encryption) |

| Host Interfaces and Peripherals | Applications Core (High Performance) | Network Core (ultra-low power) |
|---------------------------------|--------------------------------------|---|
| AAR | - | 1 x AAR (Accelerated address resolver) |
| CCM | - | 1 x CCM (AES CCM mode encryption) |
| RSSI | - | 1 x RSSI (Received Signal Strength Detector), 1dB resolution. ±2 dB accuracy (valid over -103 to -33 dBm) added 13dB FEM RX LNA gain. |

Optional (External to the BL5340PA module)

| | |
|--------------------------------------|--|
| External optional 32.768 kHz crystal | Not needed for normal radio operation. Optionally, connect +/-20ppm accuracy crystal for more accurate protocol timing. Fit associated load capacitor for crystal or use nRF53 internal load capacitor, which is configurable as either 6pF, 7pF or 9pF on pins XL1, XL2. |
|--------------------------------------|--|

Programmability

| | |
|-------------------|---------------------------------|
| Zephyr RTOS | Via SWD (JTAG) 2 wire interface |
| Nordic nRFConnect | Via SWD (JTAG) 2 wire interface |

Supply Voltage

| | |
|----------------|--|
| VDD and VDD_HV | Normal voltage mode 3.0V- 3.6 V – Internal DCDC converter or LDO MUST connect external supply (3V-3.6V) to BOTH VDD and VDD_HV pins |
|----------------|--|

Power Consumption

| | |
|--|------------------------------|
| Active Modes Peak Current (for maximum BLE Tx power +18.5 dBm) | 99.7 mA peak Tx (with DCDC) |
| maximum IEEE 802.15.4-2006 Tx power +21.0 dBm – Radio only, running radio test FW | 133.1 mA peak Tx (with DCDC) |

| | |
|--|-----------------------------|
| Active Modes Peak Current (for Tx power -20 dBm) – Radio only, radio test FW | 39.9 mA peak Tx (with DCDC) |
|--|-----------------------------|

| | |
|------------------------------|--|
| Active Modes Average Current | Depends on many factors, see 4 Power Consumption |
|------------------------------|--|

| | | |
|-----------------------|----------------|--|
| Ultra-low Power Modes | System ON Idle | 3.1 uA (wake on any event, full 512kB RAM retention) |
| | System OFF | 0.9 uA (wake on reset) |

Antenna Options

| | |
|----------|---|
| Internal | Printed PCB monopole antenna – on-board (453-00068 variant) |
| External | Connection via <i>on module</i> IPEX MHF4 – 453-00076 variant (IPEX MHF4 RF connector) See the Regulatory section and Regulatory Information Guide for FCC, ISED and RCM. The certified list of external antennas is listed in External Antenna Integration with the 453-00076 section. |

| Physical | |
|-------------------|--|
| Dimensions | 21.0 mm x 10 mm x 2.55 mm Pad Pitch – 0.8 mm Pad Type – Three rows of pads (LGA - Land Grid Array) plus row of GND pads. |
| Weight | <1 gram |
| Environmental | |
| Operating | -40 °C to +105 °C |
| Storage | -40 °C to +105 °C |
| Miscellaneous | |
| Lead Free | Lead-free and RoHS compliant |
| Warranty | One-Year Warranty |
| Development Tools | |
| Development Kit | Development kit per module SKU (453-00068-K1 and 453-00076-K1 respectively) |
| Approvals | |
| Bluetooth® | Full Bluetooth SIG Declaration ID |
| FCC/ISED/RCM | All BL5340PA Series |

Module Specification Notes:

- Note 1** **MANDATORY.** See section 6.2.4 for actual radio regulatory RF TX power limit allowed for each regulatory region per radio PHY per channel per BL5340PA hardware variant.
- BL5340PA is regulatory certified using the nRF21540 Front End module default FIXED TX_gain=PAOUT_PROD=20dB±0.5dB programmed by Nordic into nRF21540 chip by chip and BL5340PA customer must NOT change this, otherwise will invalidate certifications.
- BL5340PA is regulatory certified with nRF5340 VREQCTRL turned OFF and BL5340PA customer must NOT change this, otherwise will invalidate certifications.
- Compared to CH11(2405MHz)-CH25(2475MHz), the CH26 (2480MHz) IEEE 802.15.4:2006 RF TX power MUST be reduced to a lower value to pass FCC/ISED/NCC Band Edge emissions limit.

3 HARDWARE SPECIFICATIONS

3.1 Block Diagram and Pin-out

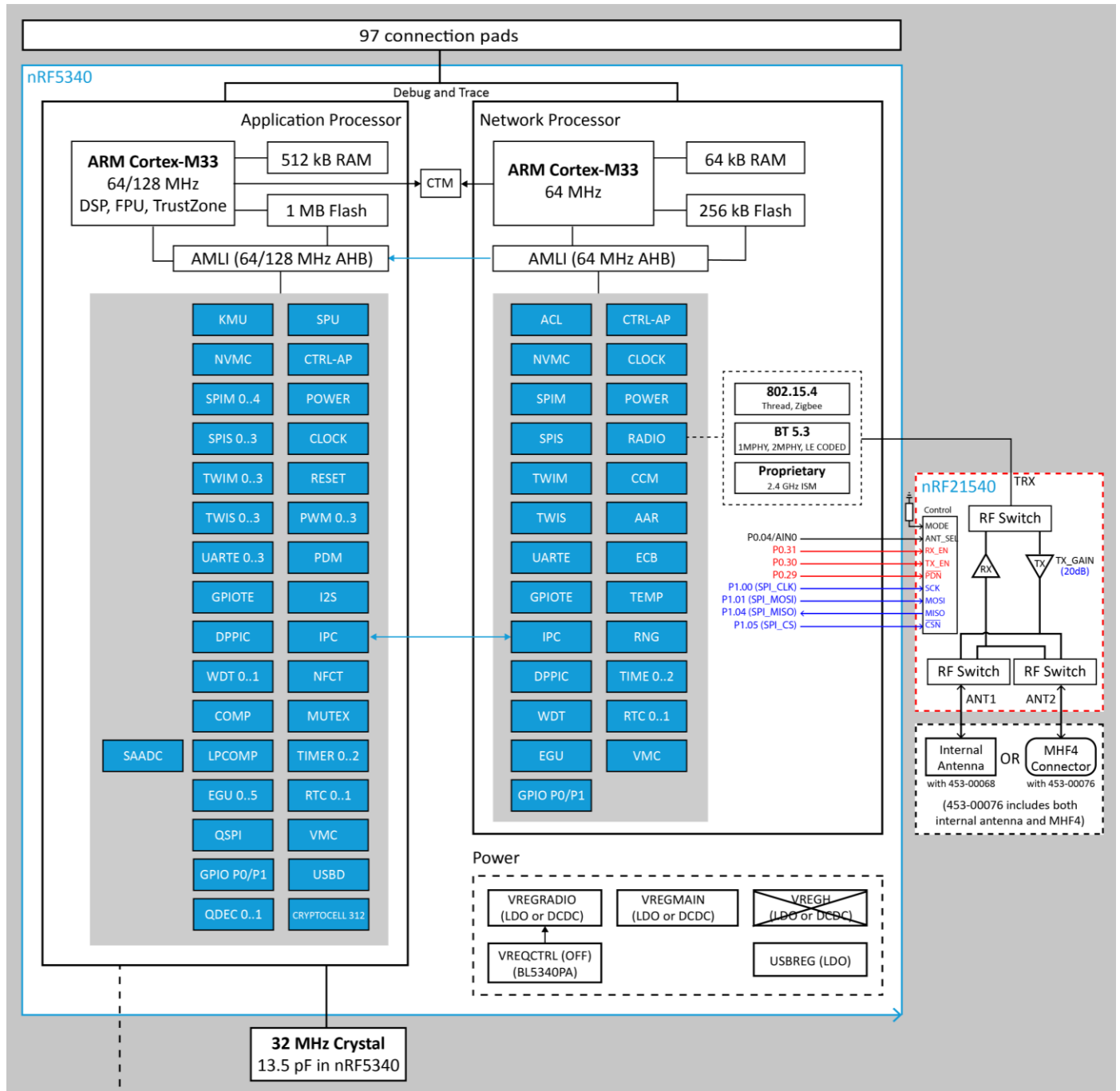


Figure 1: BL5340PA HW block diagram

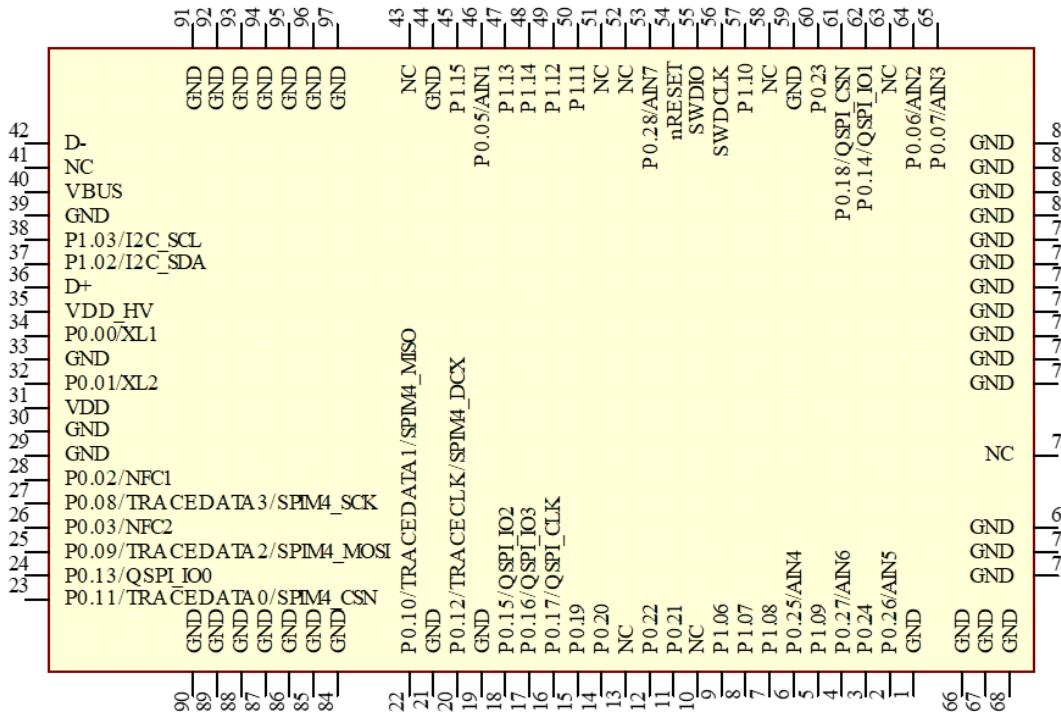


Figure 2: Top view - Combined schematic symbol for 453-00068 BL5340PA Multi-Core/Protocol -Bluetooth +802.15.4+NFC Module (Nordic nRF5340) - Integrated Antenna and schematic symbol for 453-00076 BL5340PA Multi-Core/Protocol -Bluetooth +802.15.4+NFC Module (Nordic nRF5340) -MHF4 RF connector

3.2 Pin Definitions

Table 1: Pin definitions

| Pin # | Pin Name | nRF5340 QFN Pin | nRF5340 QFN Name | Comment |
|-------|--------------|-----------------|------------------|---|
| 1 | GND | - | VSS | - |
| 2 | P0.26 / AIN5 | AL29 | P0.26 / AIN5 | Dedicated pin for ADC Laird Connectivity Devkit: Ethernet chip SPI_MISO |
| 3 | P0.24 | AL27 | P0.24 | Laird Connectivity Devkit: INT2_ACC interrupt from 3-axis accelerometer chip |
| 4 | P0.27 / AIN6 | AK30 | P0.27 / AIN6 | Dedicated pin for ADC Laird Connectivity Devkit: Ethernet chip SPI_MOSI |
| 5 | P1.09 | AK26 | P1.09 | Laird Connectivity Devkit: UART1_CTS |
| 6 | P0.25 / AIN4 | AK28 | P0.25 / AIN4 | Dedicated pin for ADC Laird Connectivity Devkit: Ethernet chip SPI_CS |
| 7 | P1.08 | AL23 | P1.08 | Laird Connectivity Devkit: UART1_TX |
| 8 | P1.07 | AK24 | P1.07 | Laird Connectivity Devkit: UART1_RTS |
| 9 | P1.06 | AL21 | P1.06 | Laird Connectivity Devkit: Interrupt from Port Expander chip PE_INT |
| 10 | P1.05 | AK22 | P1.05 | See Note 6 |
| 11 | P0.21 | AL15 | P0.21 | Laird Connectivity Devkit: UART0_CTS |
| 12 | P0.22 | AK18 | P0.22 | Laird Connectivity Devkit: UART0_RX |
| 13 | P1.04 | AL19 | P1.04 | See Note 6 |
| 14 | P0.20 | AK16 | P0.20 | Laird Connectivity Devkit: UART0_TX |
| 15 | P0.19 | AL13 | P0.19 | Laird Connectivity Devkit: UART0_RTS |

| Pin # | Pin Name | nRF5340 QFN Pin | nRF5340 QFN Name | Comment |
|-------|---------------------------------|-----------------|---------------------------------|---|
| 16 | P0.17 / QSPI_CLK | AK12 | P0.17 / QSPI_CLK | Dedicated pin for QSPI Laird Connectivity Devkit: QSPI flash chip |
| 17 | P0.16 / QSPI_IO3 | AL9 | P0.16 / QSPI_IO3 | Dedicated pin for QSPI Laird Connectivity Devkit: QSPI flash chip |
| 18 | P0.15 / QSPI_IO2 | AK10 | P0.15 / QSPI_IO2 | Dedicated pin for QSPI Laird Connectivity Devkit: QSPI flash chip |
| 19 | GND | - | VSS | - |
| 20 | P0.12 / TRACECLK / SPIM4_DCX | AK6 | P0.12 / TRACECLK / SPIM4_DCX | Dedicated pin for High-speed SPI (SPIM4, 32Mbps) and Trace Laird Connectivity Devkit: LCD assembly SPIM4_DCX |
| 21 | GND | - | VSS | - |
| 22 | P0.10 / TRACEDATA1 / SPIM4_MISO | AK2 | P0.10 / TRACEDATA1 / SPIM4_MISO | Dedicated pin for High-speed SPI (SPIM4, 32Mbps) and Trace Laird Connectivity Devkit: LCD assembly SPIM4_SPI_MISO |
| 23 | P0.11 / TRACEDATA0 / SPIM4_CSN | AK4 | P0.11 / TRACEDATA0 / SPIM4_CSN | Dedicated pin for High-speed SPI (SPIM4, 32Mbps) and Trace. SWO also comes out on P0.11 Laird Connectivity Devkit: LCD assembly SPIM4_CS |
| 24 | P0.13 / QSPI_IO0 | AL5 | P0.13 / QSPI_IO0 | Dedicated pin for QSPI Laird Connectivity Devkit: QSPI flash chip |
| 25 | P0.09 / TRACEDATA2 / SPIM4_MOSI | AJ1 | P0.09 / TRACEDATA2 / SPIM4_MOSI | Dedicated pin for High-speed SPI (SPIM4, 32Mbps) and Trace Laird Connectivity Devkit: LCD assembly SPIM4_MOSI |
| 26 | P0.03 / NFC2 | AA1 | P0.03 / NFC2 | Dedicated pin for NFC Laird Connectivity Devkit: NFC Coil flexi-PCB NFC antenna plug into CON2 |
| 27 | P0.08 / TRACEDATA3 / SPIM4_SCK | AH2 | P0.08 / TRACEDATA3 / SPIM4_SCK | Dedicated pin for High-speed SPI (SPIM4, 32Mbps) and Trace Laird Connectivity Devkit: LCD assembly SPIM4_SCL |
| 28 | P0.02 / NFC1 | W1 | P0.02 / NFC1 | Dedicated pin for NFC Laird Connectivity Devkit: NFC Coil flexi-PCB NFC antenna plug into CON2 |
| 29 | GND | - | VSS | - |
| 30 | GND | - | VSS | - |
| 31 | VDD | A19, B8, L1 | VDD | 3.0V to 3.6V Normal voltage mode operation only. External supply MUST be connected to both VDD(pin31) and VDD_HV (pin35). See 3.6 BL5340PA Power Supply Options |
| 32 | P0.01 / XL2 | R1 | P0.01 / XL2 | Dedicated pin for NFC Laird Connectivity Devkit: Optional 32.768kHz crystal pad XL2 and associated 7pF load capacitor inside nRF5340 chipset. |
| 33 | GND | - | VSS | - |
| 34 | P0.00 / XL1 | N1 | P0.00 / XL1 | Dedicated pin for NFC |

| Pin # | Pin Name | nRF5340 QFN Pin | nRF5340 QFN Name | Comment |
|-------|------------------|-----------------|------------------|---|
| | | | | Laird Connectivity Devkit: Optional 32.768kHz crystal pad XL1 and associated 7pF load capacitor inside nRF5340 chipset. |
| 35 | VDD_HV | E1 | VDD_HV | 3.0V – 3.6V Normal voltage mode operation only. External supply MUST connected to both VDD(pin31) and VDD_HV (pin35). See 3.6 BL5340PA Power Supply Options |
| 36 | D+ | B2 | D+ | Laird Connectivity Devkit: USB3 |
| 37 | P1.02 / I2C_SDA | AE1 | P1.02 / I2C_SDA | Dedicated pins for High-speed TWI (1Mbps). |
| 38 | P1.03 / I2C_SCL | AF2 | P1.03 / I2C_SCL | Laird Connectivity Devkit: Multiple I2C sensors:- 3-axis Accelerometer chip, LCD assembly, RTC chip, Temp/Pres/HMD sensor chip, DAC chip, Eeprom chip, Port Expander (PE) chip which has 4 LED's, 4 BUTTONS connected to PE chip. |
| 39 | GND | - | VSS | - |
| 40 | VBUS | A5 | VBUS | 4.35V – 5.5V See 3.6 BL5340PA Power Supply Options |
| 41 | NC | M2 | P1.00 | See Note 6 |
| 42 | D- | B4 | D- | Laird Connectivity Devkit: USB3 |
| 43 | NC | P2 | P1.01 | See Note 6 |
| 44 | GND | - | - | - |
| 45 | P1.15 | B14 | P1.15 | Laird Connectivity Devkit: SD card DO/DAT0 |
| 46 | P0.05 / AIN1 | Y2 | P0.05 / AIN1 | Dedicated pin for ADC Laird Connectivity Devkit: LCD assembly LCD_CTP_INT |
| 47 | P1.13 | A17 | P1.13 | Laird Connectivity Devkit: SD card DI/CMD |
| 48 | P1.14 | B16 | P1.14 | Laird Connectivity Devkit: SD card SCLK/CLK |
| 49 | P1.12 | B18 | P1.12 | Laird Connectivity Devkit: SD card CS_SD/DAT3 |
| 50 | P1.11 | B20 | P1.11 | Laird Connectivity Devkit: BOOT BUTTON (S4) |
| 51 | NC | B22 | P0.31 | See Note 6 |
| 52 | NC | B24 | P0.30 | See Note 6 |
| 53 | P0.28 / AIN7 | AE31 | P0.28 / AIN7 | Dedicated pin for ADC Laird Connectivity Devkit: Ethernet chip SPI_SCK |
| 54 | nRESET | AC31 | nRESET | System Reset (Active Low). Internal 13K pull up inside nRF5340. |
| 55 | SWDIO | AA31 | SWDIO | Pull up resistor (13K) inside nRF5340 |
| 56 | SWDCLK | W31 | SWDCLK | Pull down resistor (13K) inside nRF5340 |
| 57 | P1.10 | R31 | P1.10 | Laird Connectivity Devkit: UART1_RX |
| 58 | NC | U31 | P0.29 | See Note 6 |
| 59 | GND | - | VSS | - |
| 60 | P0.23 | AK20 | P0.23 | Laird Connectivity Devkit: INT1_ACC interrupt from 3-axis accelerometer |
| 61 | P0.18 / QSPI_CSN | AK14 | P0.18 / QSPI_CSN | Dedicated pin for QSPI Laird Connectivity Devkit: QSPI flash chip |
| 62 | P0.14 / QSPI_IO1 | AK8 | P0.14 / QSPI_IO1 | Dedicated pin for QSPI Laird Connectivity Devkit: QSPI flash chip |

| Pin # | Pin Name | nRF5340 QFN Pin | nRF5340 QFN Name | Comment |
|-------|--------------|-----------------|------------------|---|
| 63 | NC | V2 | P0.04 / AIN0 | See Note 6 |
| 64 | P0.06 / AIN2 | AB2 | P0.06 / AIN2 | Dedicated pin for ADC Laird Connectivity Devkit: LCD assembly LCD_Reset |
| 65 | P0.07 / AIN3 | AD2 | P0.07 / AIN3 | Dedicated pin for ADC Laird Connectivity Devkit: Interrupt from Ethernet chip INT_ETH |
| 66 | GND | - | VSS | - |
| 67 | GND | - | VSS | - |
| 68 | GND | - | VSS | - |
| 69 | GND | - | VSS | - |
| 70 | GND | - | VSS | - |
| 71 | GND | - | VSS | - |
| 72 | NC | - | - | - |
| 73 | GND | - | VSS | - |
| 74 | GND | - | VSS | - |
| 75 | GND | - | VSS | - |
| 76 | GND | - | VSS | -added pin on BL5340PA |
| 77 | GND | - | VSS | -added pin on BL5340PA |
| 78 | GND | - | VSS | -added pin on BL5340PA |
| 79 | GND | - | VSS | -added pin on BL5340PA |
| 80 | GND | - | VSS | -added pin on BL5340PA |
| 81 | GND | - | VSS | -added pin on BL5340PA |
| 82 | GND | - | VSS | -added pin on BL5340PA |
| 83 | GND | - | VSS | -added pin on BL5340PA |
| 84 | GND | - | VSS | -added pin on BL5340PA |
| 85 | GND | - | VSS | -added pin on BL5340PA |
| 86 | GND | - | VSS | -added pin on BL5340PA |
| 87 | GND | - | VSS | -added pin on BL5340PA |
| 88 | GND | - | VSS | -added pin on BL5340PA |
| 89 | GND | - | VSS | -added pin on BL5340PA |
| 90 | GND | - | VSS | -added pin on BL5340PA |
| 91 | GND | - | VSS | -added pin on BL5340PA |
| 92 | GND | - | VSS | -added pin on BL5340PA |
| 93 | GND | - | VSS | -added pin on BL5340PA |
| 94 | GND | - | VSS | -added pin on BL5340PA |
| 95 | GND | - | VSS | -added pin on BL5340PA |
| 96 | GND | - | VSS | -added pin on BL5340PA |
| 97 | GND | - | VSS | -added pin on BL5340PA |

Pin Definition Notes:

| | |
|--|---|
| Note 1 GPIO | <p>GPIO = General Input or Output (GPIO level voltage tracks VDD pin). AIN =Analog input. If GPIO is selected as an input, ensure the input is not floating (which can cause current consumption to drift with time in low power modes (such as System ON Idle), by selecting the internal pull up or pull down. Must connect all GND pads to host board PCB GND plane.</p> |
| Note 2 QSPI/SPI/TWI/Trace | <p>QSPI, High-Speed SPI (SPIM4) 32 Mbps, TWI 1 Mbps and Trace come on dedicated GPIO pins only. Other lower speed SPI (16 Mbps, 8 Mbps, 4 Mbps, 2 Mbps, 1 Mbps, 500 kbps, 250 kbps, 125 kbps) and TWI (400 kbps, 250 kbps, 100 kbps) can come out on any GPIO pins.</p> |

Pin Definition Notes:

| | |
|---|--|
| <p>Note 3 USB</p> | <p>If using the USB interface, then the BL5340PA VBUS pin (pin40) must be connected to external supply within the range 4.35V to 5.5V. When using the BL5340PA VBUS pin (pin40), you MUST externally fit a 4.7uF to ground.</p> |
| <p>Note 4 SWDIO / SWCLK / nRESET / VDD / GND</p> | <p>Customer MUST bring out SWDIO, SWCLK, nRESET, VDD, GND for programming purposes. A reset in the system is triggered by either a system level or core level reset source. A system level reset resets all cores. Examples of system level resets – power-on reset, brownout reset, and pin reset. Examples of core level resets – soft reset, lockup (resets either the entire core or only part of it). Refer to the nRF5340 datasheet for more details: https://infocenter.nordicsemi.com/topic/ps_nrf5340/keyfeatures_html5.html?cp=3_0_0 SWD- Two-wire interface</p> |
| <p>Note 5</p> | <p>Pin72 for the BL5340PA module is No Connect.</p> |
| <p>Note 6 BL5340PA NC pins</p> | <p>The 8 GPIOs signals on BL5340 module (P0.04/AIN0, P0.29, P0.30, P0.31, P1.00, P1.01, P1.04, P1.05) are NC pins on BL5340PA module series.</p> |

3.3 Electrical Specifications

3.3.1 Absolute Maximum Ratings

Absolute maximum ratings are the extreme limits for supply voltage and voltages on digital and analogue pins of the module are listed below; exceeding these values causes permanent damage.

Table 2: Absolute maximum ratings

| Parameter | Min | Max | Unit |
|---|------|-------------------|--------------------|
| Voltage at VDD pin | -0.3 | +3.6 (Note 1) | V |
| Voltage at VDD_HV pin | -0.3 | +3.6 | V |
| VBUS | -0.3 | +5.8 | V |
| Voltage at GND pin | | 0 | V |
| Voltage at GPIO pin (at $VDD \leq 3.6V$) | -0.3 | $VDD + 0.3$ | V |
| Voltage at GPIO pin (at $VDD \geq 3.6V$) | -0.3 | 3.9 | V |
| NFC antenna pin current (NFC1/2) | - | 80 | mA |
| Radio RF input level | - | -10.5 | dBm |
| Environmental | | | |
| Storage temperature | -40 | +105 | °C |
| MSL (Moisture Sensitivity Level) | - | 4 | - |
| ESD (as per EN301-489) | | | |
| Conductive | | 4 | kV |
| Air Coupling | | 8 | kV |
| Flash Memory (Endurance) (Note 2) | - | 10000 | Write/erase cycles |
| Flash Memory (Retention) | - | 10 years at 40 °C | - |

Absolute maximum Ratings Notes:

| | |
|---------------|---|
| Note 1 | The absolute maximum rating for VDD and VDD_HV pins (max) is 3.6V for the BL5340PA. |
| Note 2 | Wear levelling can be implemented by customer. |

3.3.2 Recommended Operating Parameters

Table 3: Power supply operating parameters

| Parameter | Min | Typ | Max | Unit |
|--|------|-----|------|------|
| VDD (independent of DCDC) supply range | 3.0 | 3.3 | 3.6 | V |
| VDD_HV (independent of DCDC) supply range | 3.0 | 3.3 | 3.6 | V |
| VBUS USB supply range | 4.35 | 5 | 5.5 | V |
| VDD Maximum ripple or noise (See Note 1) | - | - | 10 | mV |
| Time in Power-on reset after supply reaches minimum operating voltage, depend on supply rise time. | | | | |
| VDD supply rise time (0V to 1.7V) ² 10uS | - | 0.7 | 1.0 | mS |
| VDD supply rise time (0V to 1.7V) ² >10mS | - | 0 | - | mS |
| Operating Temperature Range | -40 | +25 | +105 | °C |

Recommended Operating Parameters Notes:

| | |
|---------------|---|
| Note 1 | This is the maximum VDD or VDD_HV ripple or noise (at any frequency) that does not disturb the radio. |
| Note 2 | The on-board power-on reset circuitry may not function properly for rise times longer than the specified maximum. |

Note 3 BL5340PA power supply:

- **Normal voltage mode** – connect the external supply voltage (3.0V to 3.6V) to BOTH the VDD and VDD_HV pins (so that VDD equals VDD_HV).

If you use USB interface, then the BL5340PA VBUS pin must be connected to external supply within the range 4.35V to 5.5V. When using the BL5340PA VBUS pin, you MUST externally fit a 4.7uF to ground.

Table 4: Signal levels for interface, GPIO

| Parameter | Min | Typ | Max | Unit |
|--|----------|-----|-----------|------|
| V _{IH} Input high voltage | 0.7 VDD | | VDD | V |
| V _{IL} Input low voltage | VSS | | 0.3 x VDD | V |
| V _{OH} Output high voltage (std. drive, 0.5mA, VDD≥1.7V) | VDD -0.4 | | VDD | V |
| (high-drive, 3mA, VDD≥1.7V) | VDD -0.4 | | VDD | V |
| (high-drive, 5mA, VDD≥2.7V) | VDD -0.4 | | VDD | V |
| V _{OL} Output low voltage (std. drive, 0.5mA, VDD≥1.7V) | VSS | | VSS+0.4 | V |
| (high-drive, 3mA, VDD≥1.7V) | VSS | | VSS+0.4 | V |
| (high-drive, 5mA, VDD≥2.7V) | VSS | | VSS+0.4 | V |
| V _{OL} Current at VSS+0.4V, Output set low (std. drive, VDD≥1.7V) | 1 | 2 | 4 | mA |
| (high-drive, VDD≥1.7V) | 3 | - | - | mA |
| (high-drive, VDD≥2.7V) | 6 | - | - | mA |
| QSPI (high-drive, VDD≥1.7V)) | - | 10 | - | mA |
| TWIM (high-drive, VDD≥1.7V)) | - | 50 | - | mA |
| V _{OH} Current at VDD -0.4, Output set high (std. drive, VDD≥1.7V) | 1 | 2 | 3 | mA |
| (high-drive, VDD≥2.7V) | 6 | - | - | mA |
| (high-drive, VDD≥1.7V) | 3 | - | - | mA |
| QSPI (high-drive, VDD≥1.7V)) | - | 10 | - | mA |
| Pull up resistance | | 13 | | kΩ |
| Pull down resistance | | 13 | | kΩ |
| Pad capacitance | | 1.5 | | pF |
| Pad capacitance at NFC pads | | 4 | | pF |
| Leakage current between NFC pads when driven to different states | | 1 | 10 | uA |

Signal Levels Notes:

Note 1 The GPIO (GPIO) high reference voltage always equals the level on the **VDD** pin.

- Normal voltage mode – The GPIO high level equals the voltage supplied to the VDD pin (and VDD_HV pin)

Table 5: GPIO pin alternative function AIN (ADC) specification

| Parameter | Min | Typ | Max | Unit |
|---|------------------------------|----------------------------------|---------|--------------|
| ADC channels (AIN), single ended (SE) or differential | | SE or DE | | |
| ADC channels (AIN) | | AIN0 to AIN7 | | |
| ADC channels other through VDD pin | | VDD | | |
| ADC channels other through VDDH pin | | VDDHDIV5 | | |
| ADC modes (single channel) | | One-shot mode or Continuous mode | | |
| ADC modes (multiple channel) | | Scan mode | | |
| ADC Internal reference voltage Input range or | | (±0.6)/Gain | | V |
| ADC External VDD as reference voltage Input range | | (±VDD/4)/Gain | | V |
| ADC pin input | | | | Scaling gain |
| internal selectable scaling gain | | 4, 2, 1, 1/2, 1/3, 1/4, 1/5 1/6 | | gain |
| ADC input pin (AIN) voltage maximum without damaging ADC w.r.t (see Note 1) | | | | |
| VCC Prescaling (Gain) | | | | |
| 0V-VDD | 4, 2, 1, ½, 1/3, ¼, 1/5, 1/6 | VSS | VDD+0.3 | V |
| Configurable Resolution | 8 | 10 | 12 | bits |
| Configurable Resolution with oversampling | - | - | 14 | bits |
| Maximum sampling rate | | | 200 | kHz |
| Configurable (see Note 2) | | | | |
| Acquisition Time, source resistance ≤10kΩ | | 3 | | µS |
| Acquisition Time, source resistance ≤40kΩ | | 5 | | µS |
| Acquisition Time, source resistance ≤100kΩ | | 10 | | µS |
| Acquisition Time, source resistance ≤200kΩ | | 15 | | µS |
| Acquisition Time, source resistance ≤400kΩ | | 20 | | µS |
| Acquisition Time, source resistance ≤800kΩ | | 40 | | µS |
| Conversion Time (see Note 3) | | 2 | | µS |
| ADC input impedance (during operation) (see Note 3) | | | | |
| Input Resistance | | 1 | | MΩ |
| Sample and hold capacitance at maximum gain | | 2.5 | | pF |

Recommended Operating Parameters Notes:

Note 1 On AIN pin, do not violate ADC maximum input voltage (for damage) for a given VDD, e.g. With internal reference, single ended input (ground negative input) and gain of 1/6, the input range is equal to (0.6V)/(1/6) or 3.6V. If VDD is 3.6V, you can only expose AIN pin to VDD+0.3 V. With reference chosen as VDD, single ended input (ground negative input) and gain of 1/4 the input range is equal to (VDD/4)/(1/4) or VDD.

Note 2 ADC resolution (8-bit, 10-bit, 12-bit, 14bit mode), acquisition time, gain, reference voltage source, single ended or differential input, ADC mode and oversampling (for 14bit mode) are configurable. BL5340PA ADC is a Successive Approximation type ADC (SSADC). As a result, no external capacitor is needed for ADC operation. Configure the acquisition time according to the source resistance of external connection to ADC (that customer has).

In Continuous mode, the sampling frequency is limited by the sum of sampling time and acquisition time ($f_{\text{sample}} < 1/(t_{\text{ACQ}} + t_{\text{conv}})$). The maximum sampling time is 2µs. For acquisition time of 3µs the total conversion time is therefore 5µs, which makes maximum sampling frequency of $1/5\mu\text{s} = 200\text{kHz}$. Similarly, if acquisition time of 40µs chosen, then the conversion time is 42µs and the maximum sampling frequency is $1/42\mu\text{s} = 23.8\text{kHz}$.

In scan mode the sample time is the time it takes to sample all channels (Total sample time < Sum(CH[x] x ((t_{ACQ} + t_{conv}))) where x=0..enabled channels).

When using VDDHDIV5 as input, the acquisition time needs to be 10µS or higher.

Note 3 ADC input impedance is estimated mean impedance of the ADC (AIN) pins.

3.4 Application Core and Network Core

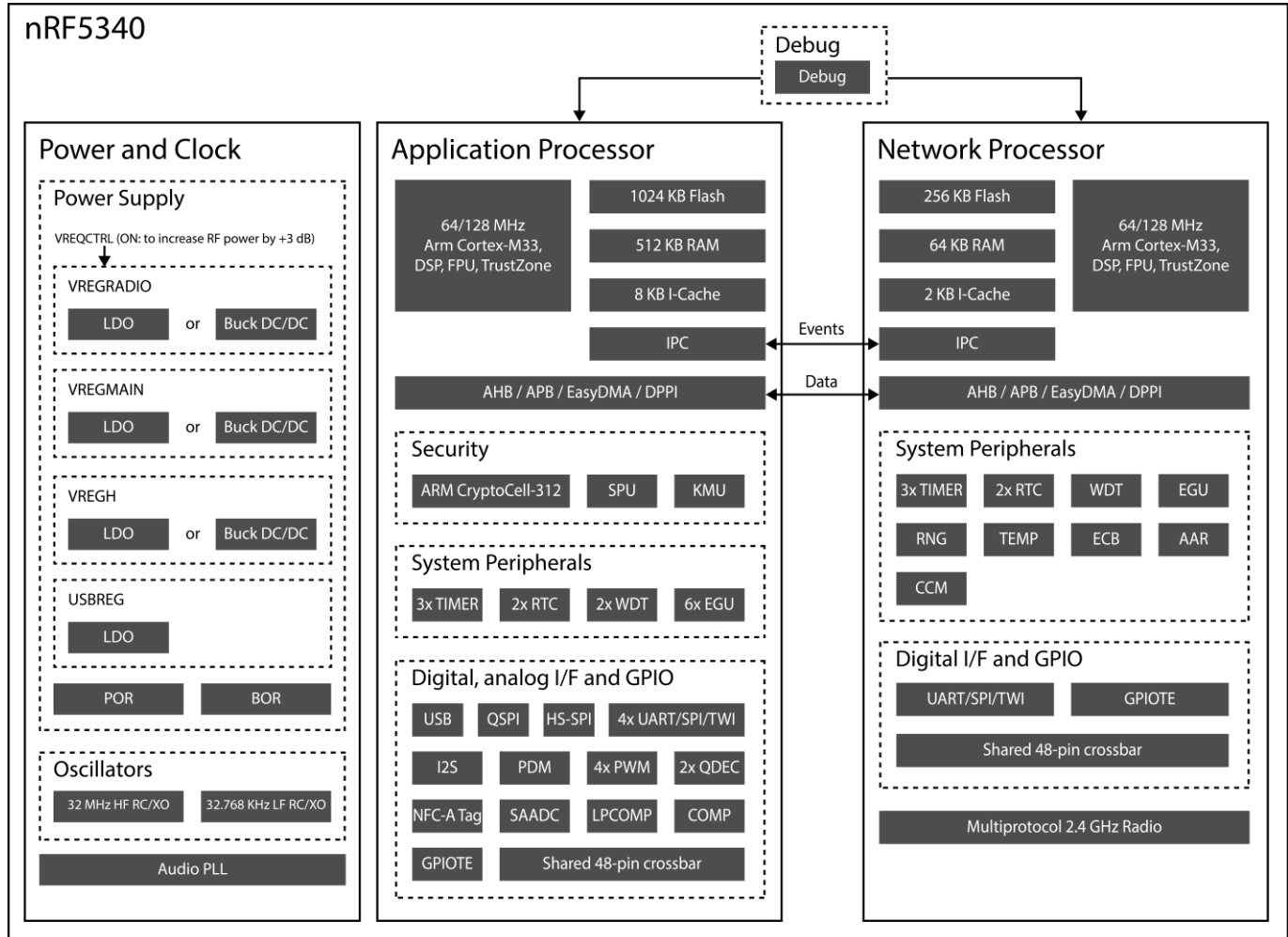


Figure 3: nRF5340 SoC SW block diagram (adapted from Nordic)

nRF5340 SoC (block diagram Figure 3) contains two processors:

- Applications Core (high performance)
 - Arm Cortex-M33 with DSP (Digital Signal Processing) and FPU (Floating Point Unit), TrustZone support, 1024 kB Flash, 512 kB RAM, 8 kB 2-way set associative cache (serves both internal and external memory), 128 MHz and 64 MHz clock speed, fully programmable and optimized for performance and uses voltage and clock frequency scaling.
 - Security (Figure 3)
 - System Peripherals (Figure 3)
 - Digital, analog interfaces and GPIO (Figure 3)
- Network Core (ultra-low power)
 - Arm Cortex-M33, 256 kB Flash, 64 kB RAM, 2 kB instructions cache, 64 MHz clock speed, fully programmable and optimized for efficiency
 - System Peripherals (Figure 3)
 - Digital interfaces and GPIO (Figure 3)
 - Radio (Figure 3)

3.5 Clocks

3.5.1 HFXO - 32MHz crystal oscillator and nRF5340 internal load capacitor 13.5pF mandatory setting

The BL5340PA module contains the 32 MHz crystal, but the load capacitors to create 32MHz crystal oscillator circuit are inside the nRF5340 chipset. Customer MUST set the internal nRF5340 capacitors to 13.5pF (for proper operation of the 32 MHz crystal circuit).

The 32 MHz crystal inside the BL5340PA module is a high accuracy crystal (± 15 ppm at room temperature) that helps with radio operation and reducing power consumption in the active modes.

3.5.2 LFCLK – Low Frequency clock source

There are four possibilities (see figure 5) for the low frequency clock (LFCLK) and options are:

LFRC (32.768kHz RC oscillator): The Internal 32.768 kHz RC oscillator (LFRC) is fully embedded in nRF5340 (and does not require additional external components) with an accuracy ± 250 ppm (after calibration of LFRC at least every eight seconds using the HFXO as a reference oscillator). See section [LFXO - OPTIONAL 32.768kHz Crystal and Load Capacitor](#).

LFXO (32.768kHz crystal oscillator): For higher LFCLK accuracy (greater than ± 250 ppm accuracy is required), the low frequency crystal oscillator (LFXO) must be used. To use LFXO, a 32.768kHz crystal must be connected between the XL1 and XL2 pins and the load capacitance between each crystal terminal and ground. Optionally internal (to nRF53) capacitors of 6pF, 7pF and 9pF are provided on pins XL1 and XL2. See section [LFXO - OPTIONAL 32.768kHz Crystal and Load Capacitor](#).

Low frequency (32.768 kHz) external source: The 32.768 kHz oscillator (LFXO) is designed to work with external sources. Following external sources are supported:

- **A low swing clock. The signal should be applied to the XL1 pin with XL2 pin grounded.**
 - In "external low-swing mode" the clock signal can either be a sinewave or a square wave, but it's not allowed to be rail-to-rail. The signal is passed through the LFXO module for amplification and conversion into a digital clock. The amplifier requires a peak-to-peak input amplitude of between 200mV and 1000mV; too high or low amplitude may affect the integrity of the clock. The DC offset of the external signal is flexible, but it must not be so high that XL1 peaks above VDD, or so low that XL1 dips below VSS.
- **A rail-to-rail clock. The signal should be applied to the XL1 pin with XL2 pin left unconnected.**
 - In "external full-swing mode" the LFXO is in reality disabled and the XL1 pin configured as a digital input. Hence, the external clock signal must be a digital waveform, with 'high' and 'low' levels as specified in the GPIO chapter. The full-swing mode will consume slightly less current since the internal signal amplifier is not needed and thus powered down. In "external full-swing mode" the XL2 pin is not connected to anything internally but advise to ground any unused pins.

See [LFXO - OPTIONAL 32.768kHz Crystal and Load Capacitor](#) in the last row of [Table 7](#).

LFSYNTH (32.768kHz Synthesised clock) from HFCLK (LFSYNTH): The LFCLK can be synthesised from the HFCLK source. LFSYNTH depends on the HFCLK to run. The accuracy of the LFCLK clock with LFSYNTH as a source assumes the accuracy of the HFCLK. If high accuracy is required, the HFCLK must be generated from the HFXO. Using the LFSYNTH clock removes the requirement for an external 32.768kHz crystal but increases the average power consumption as the HFCLK will be turned on in the system.

3.5.2.1 LFXO - OPTIONAL 32.768kHz Crystal and Load Capacitor

This is not required for normal BL5340PA module operation.

The nRF5340 on-chip 32.768 kHz LFRC oscillator (± 250 ppm) provides protocol timing and helps with radio power consumption in the System ON Idle and System OFF modes by reducing the time that the RX window needs to be open.

To maintain accuracy of the nRF5340 on-chip 32.768 kHz LFRC oscillator within ± 250 ppm (which is needed to run the BLE stack), LFRC oscillator needs to be calibrated (which takes 32 mS) regularly. The calibration interval is at least eight seconds which is enough to keep within ± 250 ppm.

You can connect an optional external high accuracy (± 20 ppm) 32.768 kHz crystal (and associated load capacitors can be external capacitors or use capacitance inside the nRF5340 chipset, which are configurable to either 6pF, 7pF, or 9pF) to the BL5340PA P0.01/XL2 (pin 32) and P0.00/XL1 (pin 34). This provides improved protocol timing and to help with radio power consumption in the System ON Idle or System OFF sleep modes by reducing the time that the RX window needs to be open. [Table 6](#) compares the current consumption difference between RC (LFRC) and crystal oscillator (LXFO).

Table 6: Comparing current consumption difference between BL5340PA on-chip LFRC 32.768 kHz oscillator and optional external crystal (32.768kHz) based oscillator

| | BL5340PA on-chip 32.768 kHz RC Oscillator (±250 ppm) LFRC | Optional External Higher Accuracy (±20 ppm) 32.768 kHz Crystal-based Oscillator LFXO |
|--|--|---|
| Current Consumption of 32.768 kHz Block | 1.0 uA | 0.16 uA |
| System ON idle + NET Core 64kB RAM + APP Core 8kB RAM retention +RTC run current + LFRC or LFXO) | 2.6 uA | 2.1 uA |
| Calibration | <p>Calibration required regularly (default 8s interval). Calibration takes 32 ms; with DCDC used, the total charge of a calibration event is 12.6 uC. The average current consumed by the calibration depends on the calibration interval and can be calculated using the following formula: CAL_charge/CAL_interval – The lowest calibration interval (0.25 seconds) provides an average current of (DCDC enabled): 12.6uC/0.25s = 50.4uA</p> <p>To get the ±250-ppm accuracy, the BLE stack specification states a calibration interval of 8s is enough. This gives an average calibration current of: 12.6uC/8s = 1.6uA</p> <p>Added to the LFRC run current and System ON Idle base current shown above results in a total average current of: LFRC + CAL = 2.6 + 1.6 = 4.2 uA</p> | Not applicable |
| Total | 4.2 uA | 2.1 uA |
| Summary | <ul style="list-style-type: none"> Low current consumption Accuracy ±250 ppm | <ul style="list-style-type: none"> Lowest current consumption Needs external crystal High accuracy (depends on crystal, usually ±20 ppm) |

Results with below test setup:

- Network core enabled
 - DCDC enabled
 - 64kB RAM retained
 - RTC enabled
 - Running BLE stack
- Application core enabled
 - DCDC enabled
 - 8kB RAM retained
 - RTC enabled
 - Running zephyr OS
- 3V supply on VDD
 - VDDH disabled
 - DCDC VDDH disabled

Table 7: Optional external 32.768 kHz crystal specification and Low frequency (32.768kHz) external source specification

| Optional external 32.768kHz crystal | Min | Typ | Max |
|-------------------------------------|-----|------------|-----|
| Crystal Frequency | - | 32.768 kHz | - |

| Optional external 32.768kHz crystal | Min | Typ | Max |
|---|--------|---------|----------|
| Frequency tolerance requirement of BLE stack | - | - | ±500 ppm |
| Load Capacitance | - | 7 pF | 9 pF |
| Shunt Capacitance | - | 1 pF | 2 pF |
| Equivalent series resistance | - | 60 kOhm | 90 kOhm |
| Drive level | - | - | 0.5 μW |
| Input capacitance on XL1 and XL2 pads with internal capacitor disabled | - | 4 pF | - |
| Input capacitance on XL1 and XL2 pads with internal capacitor enabled | 6 pF | 7 pF | 9 pF |
| Peal to peak amplitude for external low swing clock . Input signal must not be outside supply rails. The allowable input amplitude range in low-swing mode does not change with VDD. | 200 mV | - | 1000 mV |

Be sure to tune the load capacitors on the board design to optimize frequency accuracy (at room temperature) so it matches that of the same crystal standalone, Drive Level (so crystal operated within safe limits) and oscillation margin (R_{neg} is at least 3 to 5 times ESR) over the operating temperature range.

3.5.3 Other Internal Clocks

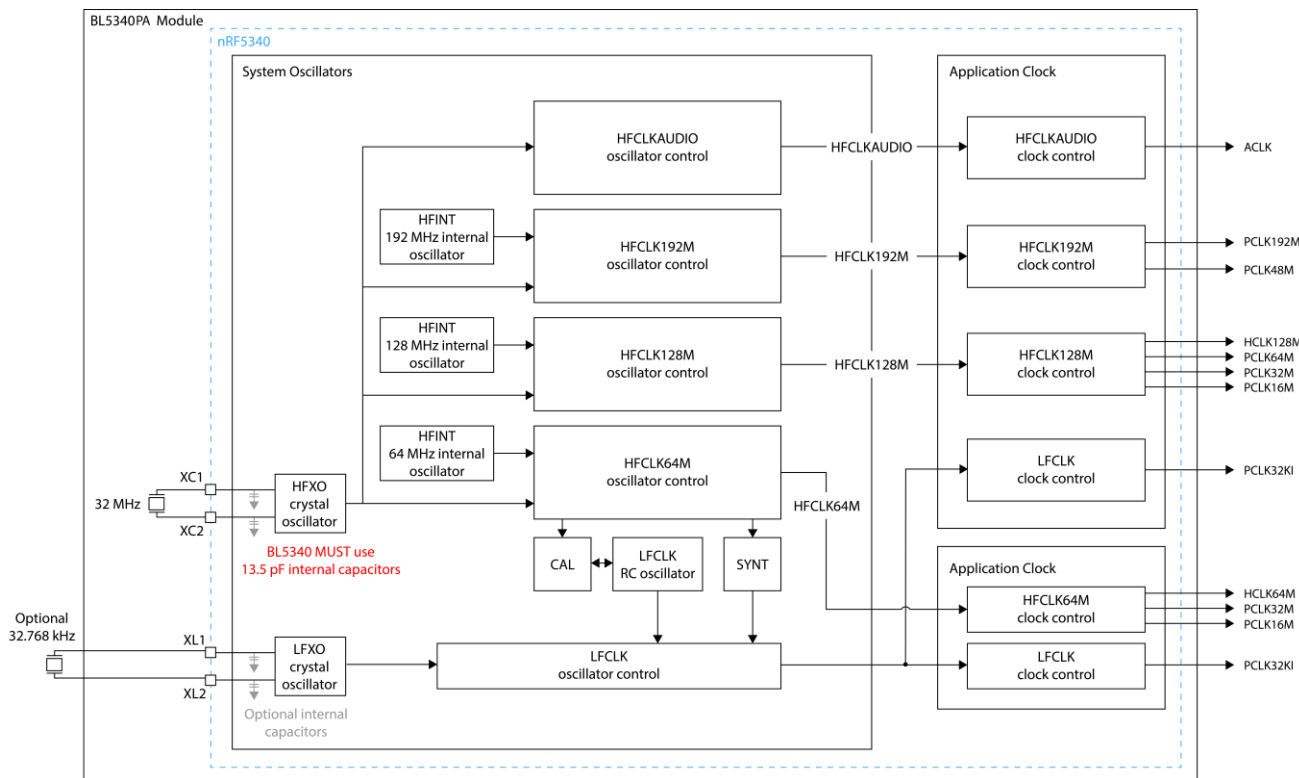


Figure 4: nRF5340 SoC clocks (adapted from Nordic)

Table 8: Core clocks

| Core clock | Description |
|------------|---|
| HFCLK128M | Scalable 128 MHz CPU clock for the application core |
| HFCLK64M | 64 MHz CPU clock for the network core |
| PCLK192M | Scalable 192 MHz clock for QSPI |
| PCLK64M | 64 MHz peripheral clock |
| PCLK48M | 48 MHz clock for USB |
| PCLK32M | 32 MHz peripheral clock |

| Core clock | Description |
|------------|--|
| PCLK16M | 16 MHz peripheral clock |
| ACLK | 11.289 MHz or 12.288 MHz tuneable audio peripheral clock |

3.6 BL5340PA Power Supply Options

Power management features:

- System ON Idle, System OFF and Force-OFF mode.
- Open/Close peripherals (UART, SPI, QSPI, I2C, GPIOs, ADC, NFC, I2S, PDM etc.). Peripherals consume current when open; each peripheral can be individually closed to save power consumption
- Use of the internal DCDC convertor or LDO
- Supply voltage to be read (through the internal ADC)
- Pin wake-up system from System OFF (including from NFC pins)

Power supply features:

- Supervisor hardware to manage power during reset, brownout, or power fail.
- Connect the external supply (3.0V to 3.6V) to BOTH VDD and VDD_HV pin to operate the BL5340PA module (in Normal Voltage mode) using internal DCDC converters or LDO
- To use the BL5340PA USB peripheral, connect the BL5340PA VBUS pin to the external supply within the range 4.35V to 5.5V range for powering USB (VBUS pin) portion of BL5340PA only. The remainder of the BL5340PA module circuitry must still be powered by connecting the external supply (3.0V to 3.6V) to BOTH VDD and VDD_HV pin to operate the BL5340PA module (in Normal Voltage mode).

The BL5340PA module power supply internally contains the following two main supply regulator stages (Figure 5).

- VREGH – Connected to the VDD_HV pin
- VREGMAIN and VREGRADIO – Connected to the VDD pin

The USB peripheral is powered separately (connected to the VBUS pin).

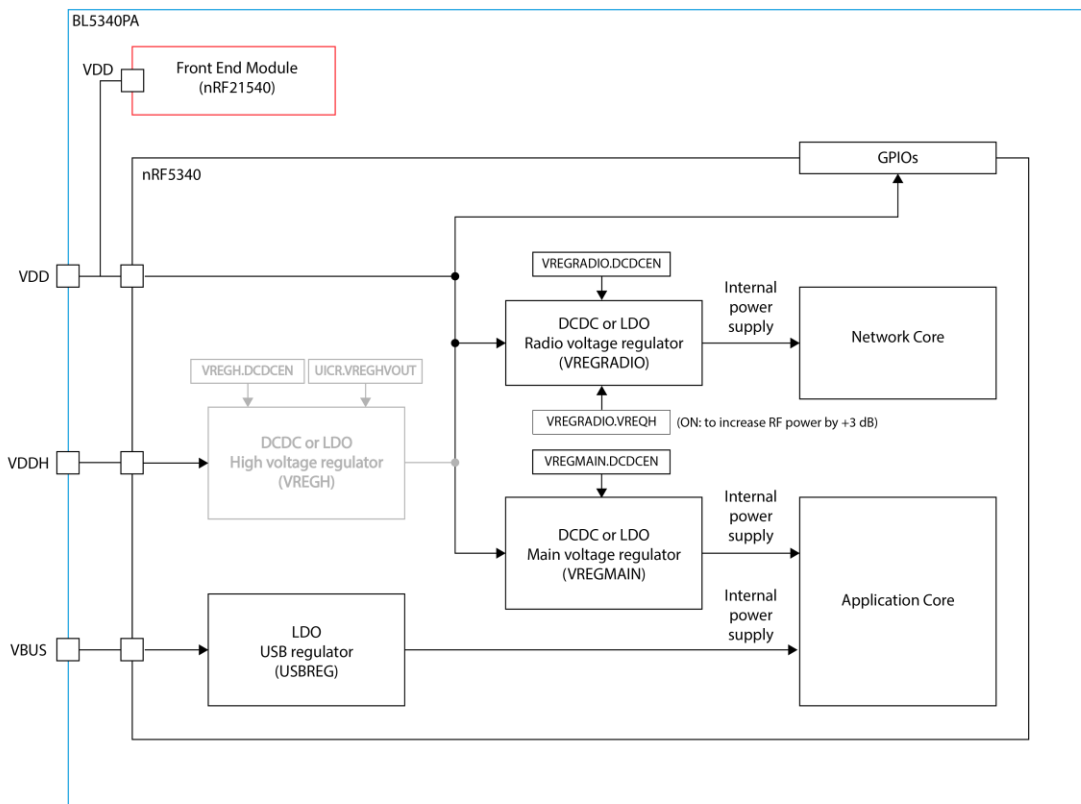


Figure 5: BL5340PA power supply block diagram (adapted from the following resource: https://infocenter.nordicsemi.com/topic/ps_nrf5340/keyfeatures_html5.html?cp=3_0_0)

3.6.1 Normal Voltage mode

The BL5340PA power supply system can be used Normal voltage mode only, for which the external supply voltage (3.0 to 3.6V) is connected to these pins.

- **Normal voltage mode:** connect the external supply voltage (3.0V to 3.6V) is connected to BOTH the VDD and VDD_HV pins (so that VDD equals VDD_HV).

If you use USB interface then the BL5340PA VBUS pin must be connected to external supply within the range 4.35V to 5.5V. When using the BL5340PA VBUS pin, you **MUST** externally fit a 4.7uF to ground. See [VBUS pin and 4.7uF Mandatory Capacitor](#) if USB peripheral is to be used.

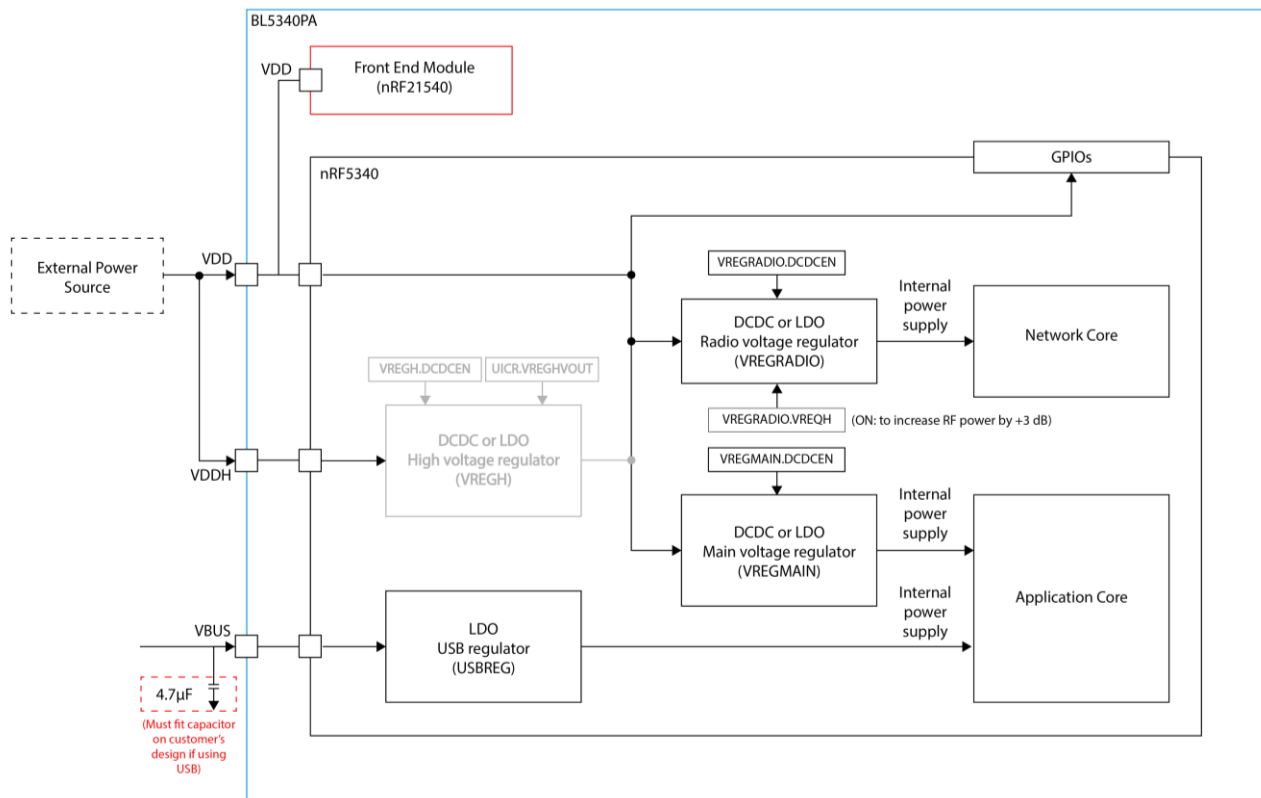


Figure 6: Normal Voltage mode

3.6.2 VBUS pin and 4.7uF Mandatory Capacitor

To use the BL5340PA USB peripheral:

1. Connect the BL5340PA VBUS pin to the external supply within the range 4.35V to 5.5V. When using the BL5340PA VBUS pin, you **MUST** externally fit a 4.7uF to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized.
2. Connect the external supply (3.0V to 3.6V) to BOTH VDD and VDD_HV pin to operate the rest of BL5340PA module.

An optional series 4.7Ohms resistor on the USB supply (VBUS) can be fitted for improved immunity to transient over-voltage VBUS connection.

If not using USB peripheral, the VBUS pin can be left unconnected.

3.6.3 VREQCTRL - Voltage request control (VREQCTRL OFF for BL5340PA)

BL5340PA is radio regulatory certified with nRF5340 VREQCTRL turned OFF. BL5340PA customer must keep the nRF5340 VREQCTRL turned OFF to stay within BL5340PA radio regulatory certifications.

See section 6.2.4 for actual radio regulatory RF TX power limit allowed for each regulatory region, per BL5340PA module HW variant, per PHY, per channel.

3.6.4 Low Power Modes

The nRF5340 chipset (BL5340PA module) has four power modes: Active, System ON Idle, System OFF and Force-OFF mode. The nRF21540 has sleep mode that is used whenever there is no RF TX or RF activity.

For low power consumption, the module can be placed automatically in System ON Idle if there are no pending events. The module wakes from System ON Idle via any interrupt (such as a received character on the UART Rx line). If the module receives a UART character from either the external UART or the radio, it wakes up.

System OFF is the lowest power mode. Once awakened, the system goes through a system reset.

Force-OFF is only applicable for network core.

3.7 Programmability

3.4.1 BL5340PA Default Firmware

The BL5340PA module is shipped from Laird Connectivity manufacturing facilities with no firmware loaded.

3.7.1 BL5340PA Firmware options

Firmware for use with the BL5340PA can be divided into three types.

- **Bootloader** – This is the application that resides on the Application Core used to perform firmware updates of the Application and Network Cores.

The MCUboot [A] or the Trusted Firmware M [B] Bootloaders can be used as the basis for BL5340PA Bootloader functionality.

- **Application** – This is the main application code that resides on the Application Core. It interfaces with the Network Core and provides supplementary functionality to that of the time critical activities being performed on the Network Core.

The BL5340PA is supported by the Nordic Connect SDK [C].

- **Radio Stack** – This is the protocol stack that resides on the Network Core. It controls the radio and performs time critical protocol related operations and provides the results of these to the Application Core for high level processing.

BLE [D], Thread [E], Zigbee [F] and 802.15.4 [G] Radio Stacks are available for use with the Nordic Connect SDK platform.

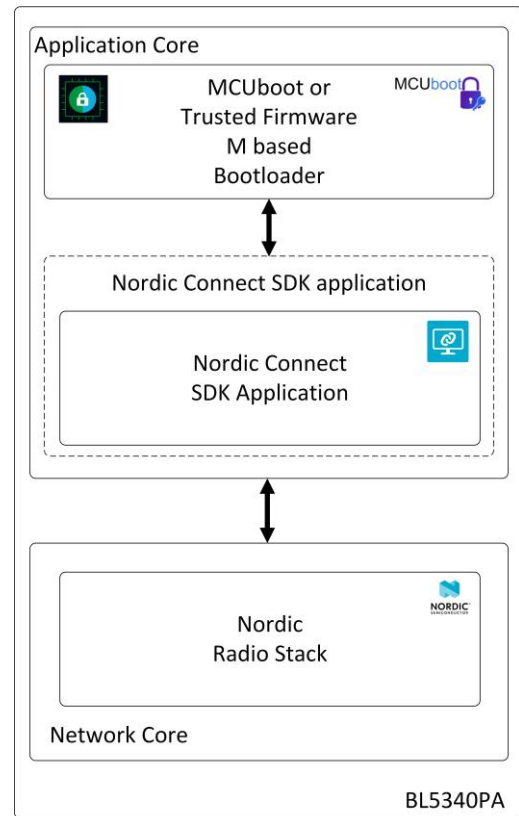


Figure 7: Functional SW block diagram for BL5340PA series BLE module

Note: Control of the BL5340PA FEM (nRF21540) is performed by the MPSL (Multiprotocol Service Layer) [H] provided as part of the Nordic Connect SDK. To ensure regulatory compliance in all regions, user applications must include Laird Connectivity provided BL5340PA driver code. This contains tables used to limit transmit power on specified radio channels.

[A] <https://github.com/mcu-tools/mcuboot>

[B] <https://www.trustedfirmware.org/>

[C] <https://www.nordicsemi.com/Software-and-tools/Software/nRF-Connect-SDK>

[D] https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrfxlib/softdevice_controller/README.html#softdevice-controller

[E] https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrf/ug_thread.html

[F] https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrf/ug_zigbee.html

[G] https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrfxlib/nrf_802154/README.html

[H] https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrfxlib/mpsl/README.html

4 POWER CONSUMPTION

Normal voltage mode VDD of 3.3 V, using internal (to chipset) DCDC or with internal (to chipset) LDO ON. Temperature 25°C.

Table 9: Power consumption

| Parameter | Typ Radio only nRF5340 | Typ Radio +Application core (20kB RAM) + Network core (64kB RAM) | BL5340PA running radio test FW, (FEM TX_Gain=20dB default) |
|--|------------------------------|--|--|
| Active mode 'peak' current (Note 1) | With DCDC [with LDO] | With DCDC [with LDO] | |
| nRF5340 RF TX setting (BL5340PA RF TX power) | | | |
| Tx only run peak current @ nRF53 Txpwr = 0 dBm (21.0dBm) | 3.4mA [9.1mA] | - | 133.1mA |
| Tx only run peak current @ nRF53 Txpwr = -4 dBm (18.5dBm) | 2.7mA [7.2mA] | - | 99.7mA |
| Tx only run peak current @ nRF53 Txpwr = -5 dBm (16.9dBm) | - | - | 89.8mA |
| Tx only run peak current @ nRF53 Txpwr = -6 dBm (17.4dBm) | - | - | 84.8mA |
| Tx only run peak current @ nRF53 Txpwr = -7 dBm (15.7dBm) | - | - | 72.7mA |
| Tx only run peak current @ nRF53 Txpwr = -8 dBm (14.6dBm) | 2.2mA [5.8mA] | - | 65.7mA |
| Tx only run peak current @ nRF53 Txpwr = -12 dBm (10.4dBm) | 2.0mA [5.0mA] | - | 50.7mA |
| Tx only run peak current @ nRF53 Txpwr = -16 dBm (6.1dBm) | 1.8mA [4.5mA] | - | 44.1mA |
| Tx only run peak current @ nRF53 Txpwr = -20 dBm (3.1dBm) | 1.7mA [4.2mA] | - | 41.9mA |
| Tx only run peak current @ nRF53 Txpwr = -40 dBm (-17.3dB) | 1.5mA [3.8mA] | - | 39.9mA |
| Active Mode | | | |
| Rx only 'peak' current, BLE 1Mbps (Note 1) | 2.7mA [6.7mA] | 8.6mA [21.5mA] | 11.6mA |
| Rx only 'peak' current, BLE 2Mbps (Note 1) | 3.1mA [7.9mA] | - | |
| Ultra-Low Power Mode 1 (Note 2) | | | |
| System ON Idle (0 k application, network core RAM retention) | 1.3uA | - | 3.1uA (512kB RAM retention) |
| Ultra-Low Power Mode 2 (Note 3) | | | |
| System OFF (0 kB application and network RAM retention) | 0.9uA | | 0.9uA |
| Active Mode Average current (Note 4) | | | |
| Advertising Average Current draw | | | |
| Max, with advertising interval (min) 20 mS | uA, Note4 | | |
| Min, with advertising interval (max) 10240 mS | uA, Note4 | | |
| Connection Average Current draw | | | |
| Max, with connection interval (min) 7.5 mS | uA, Note4 | | |
| Min, with connection interval (max) 4000 mS | uA, Note4 | | |

Power Consumption Notes:

| | |
|---------------|--|
| Note 1 | <p>This is for Peak Radio Current only (with VREQCTRL OFF). Also, additional current draw depending on Application Core and Network Core running, RAM, flash used and which peripherals on (if any).</p> <p>See section 6.2.4 for actual radio regulatory nRF5340 RF TX power setting limit allowed for each regulatory region, per BL5340PA module HW variant, per PHY, per channel.</p> |
| Note 2 | <p>BL5340PA modules System ON Idle is 1.3 uA typical (with 0kB application core RAM, wake on any event, network core RAM 0kB, network core forced off). System ON Idle is entered automatically (waiting for an event). In System ON Idle, all peripherals that are enabled stay on and may re-awaken the chip. Depending on active peripherals, current consumption ranges from 1.3 uA to 645 uA (when UART is ON, Idle). See individual peripherals current consumption data in the Peripheral Block Current Consumption section. There is functionality to detect GPIO change with no current consumption cost, it is possible to close the UART and get to the 1.3 uA current consumption regime and still be able to detect for incoming data and be woken up so that the UART can be re-opened at expense of losing that first character.</p> <p>RAM retention current per 4k block is approximately 13nA. nRF21540 in power down consumes 45nA typically.</p> |
| Note 3 | <p>In System OFF (0kB application RAM, wake on reset, network core RAM 0kB), everything is disabled, and the only wake-up sources (including NFC to wakeup) are reset and changes on GPIO or NFC pins on which sense is enabled. The current consumption seen is ~0.9 uA typical in BL5340PA modules (nRF21540 in power down consumes 45nA typically).</p> <ul style="list-style-type: none"> ▪ Coming out from System OFF to System ON Idle is through the reset vector. |
| Note 4 | <p>Average current consumption depends on several factors (including Tx power, VDD, accuracy of 32MHz and 32.768 kHz). With these factors fixed, the largest variable is the advertising or connection interval set.</p> <p>Advertising Interval range:</p> <ul style="list-style-type: none"> ▪ 20 milliseconds to 10240 mS (10485759.375 mS in BT 5.1) in multiples of 0.625 milliseconds. <p>For an advertising event:</p> <ul style="list-style-type: none"> ▪ The minimum average current consumption is when the advertising interval is large (10240 mS, or 10485759.375 mS in BT 5.1) although this may cause long discover times (for the advertising event) by scanners ▪ The maximum average current consumption is when the advertising interval is small (20 mS). <p>Other factors that are also related to average current consumption include the advertising payload bytes in each advertising packet and whether it's continuously advertising or periodically advertising.</p> <p>Connection Interval range (for a peripheral):</p> <ul style="list-style-type: none"> ▪ 7.5 milliseconds to 4000 milliseconds in multiples of 1.25 milliseconds. <p>For a connection event (for a peripheral device):</p> <ul style="list-style-type: none"> ▪ The minimum average current consumption is when the connection interval is large (4000 milliseconds) ▪ The maximum average current consumption is with the shortest connection interval of 7.5 ms; no slave latency. <p>Other factors that are also related to average current consumption include:</p> <ul style="list-style-type: none"> ▪ Number packets per connection interval with each packet payload size ▪ An inaccurate 32.768 kHz master clock accuracy would increase the average current consumption. <p>Connection Interval range (for a central device):</p> <ul style="list-style-type: none"> ▪ 2.5 milliseconds to 40959375 milliseconds in multiples of 1.25 milliseconds. |

5 PERIPHERALS

To provide the widest scope for integration, a variety of physical host interfaces/sensors are provided. The major BL5340PA series module functional blocks are described below (which are within the nRF5340). Peripherals not mentioned in this section can be looked up in the nRF5340 datasheet

https://infocenter.nordicsemi.com/topic/ps_nrf5340/keyfeatures_html5.html?cp=3_0_0

5.1 RADIO – 2.4GHz radio (RF)

- **2402–2480 MHz Bluetooth Low Energy (BLE) BT5.2 radio transceiver (nRF5340) and Front-End Module (nRF21540)**
 - -103 dBm RX sensitivity 1 Mbps BLE
 - -100 dBm RX sensitivity 2 Mbps BLE
 - -108.5 dBm RX sensitivity 125 kbps BLE coded PHY (s=8)
 - -106 dBm RX sensitivity 500 kbps BLE coded PHY (s=2)
 - Angle of Arrival (AoA) and Angle of Departure (AoD) direction finding using BLE
 - **MANDATORY.** RF Tx output power of programmable, see section 6.2.4 for actual radio regulatory RF TX power limit allowed for each regulatory region per BL5340PA module HW variant per PHY, per channel for FIXED Nordic default nRF21540 TX_Gain=POUTA_PROD=20dB±0.5dB.
 - nRF5340 RF TX power (for all RF TX power steps) with nRF5340 VREQCTRL MUST be turned OFF for BL5340PA.

- **2405–2480 MHz IEEE 802.15.5-2006 radio transceiver, implementing IEEE 802.15.5-2006 compliant**
 - 250 kbps, 2450 MHz, O-QPSK PHY
 - Channels 11-26. Channel 11 2405 MHz and CH26 2480 MHz
 - Clear channel assessment (CCA)
 - Energy detection (ED) scan
 - CRC generation
 - -107 dBm RX sensitivity IEEE 802.15.4-2006 250 kbps
 - **MANDATORY.** RF Tx output power programmable see section 6.2.4 for actual radio regulatory RF TX power limit allowed for each regulatory region per BL5340PA module HW variant per PHY, per channel for FIXED Nordic default nRF21540 TX_Gain=POUTA_PROD=20dB±0.5dB.
 - nRF5340 RF TX power (for all RF TX power steps) with nRF5340 VREQCTRL MUST be turned OFF for BL5340PA.

- **2402–2480 MHz proprietary 1 Mbps and 2 Mbps modes radio transceiver (not currently certified by Laird Connectivity)**
 - -TBD dBm RX sensitivity, 1 Mbps nRF proprietary mode (ideal transmitter)
 - -TBD dBm RX sensitivity, 2 Mbps nRF proprietary mode (ideal transmitter)
 - RF Tx output power of programmable, but actual radio regulatory RF TX power limit allowed for each regulatory region per BL5340PA module HW variant per PHY, per channel (for FIXED Nordic default nRF21540 TX_Gain=POUTA_PROD=20dB±0.5dB) not currently certified by Laird Connectivity.
 - RF TX power (for all RF TX power steps) with VREQCTRL MUST be turned OFF for BL5340PA.

- **RF interface available in the following two ways:**
 - 453-00068: RF connected to Integrated PCB trace antenna
 - 453-00076: RF connected to IPEX MHF4 RF connector
 - Antenna options: External dipole antennas connected with to IPEX MH4 RF connector module

- **Received Signal Strength Indicator (RSSI)**
 - RSSI accuracy (valid range -90 to -20dBm) is ±2dB typical
 - BL5340PA (has FEM RX LNA Gain of 13dB, so RSSI range becomes -103dBm to -33dBm)
 - RSSI resolution 1dB typical
 - Maximum Received Signal strength (at 0.1% PER) of -13dBm (gated by the FEM RX LNA gain of 13dB).

5.2 NFC Tag – Near field communication tag

The NFCT peripheral is an implementation of an NFC Forum listening device NFC-A. With appropriate software, the NFCT peripheral can be used as the listening device NFC-A as specified by the <https://nfc-forum.org/>

NFC support:

- Based on the NFC forum specification
 - 13.56 MHz
 - Data rate - 106 kbps
 - NFC Type2 and Type4 tag emulation
- Modes of operation:
 - Disable
 - Sense (Wake-on-field low power field detection (SENSE) mode)
 - Activated

5.2.1 Use Cases

- Touch-to Pair with NFC
- Launch a smartphone app (on Android)
- NFC enabled Out-of-Band Pairing
- System Wake-On-Field function
 - Proximity Detection

Table 10: NFC interface

| Signal Name | Pin No | I/O | Comments |
|-------------|--------|-----|---|
| NFC1/P0.02 | 28 | I/O | The NFC pins are by default NFC pins and an alternate function on each pin is GPIO. |
| NFC2/P0.03 | 26 | I/O | |

5.2.2 NFC Antenna Coil Tuning Capacitors

From Nordic's *nRF5340 datasheet*: https://infocenter.nordicsemi.com/topic/ps_nrf5340/keyfeatures_html5.html?cp=3_0_0

The NFC antenna coil must be the connected differential between the NFC1 and NFC2 pins of the BL5340PA. Two external capacitors should be used to tune the resonance of the antenna circuit to 13.56 MHz (Figure 8).

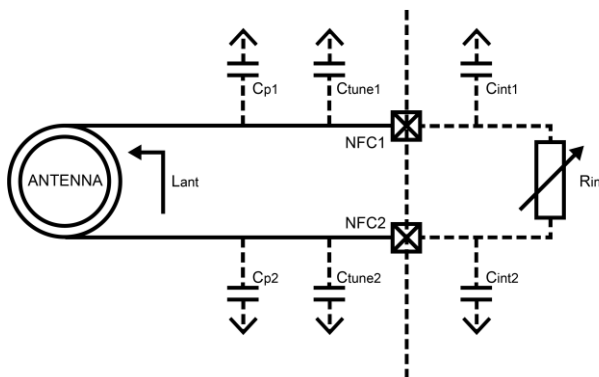


Figure 8: NFC antenna coil tuning capacitors

The required external tuning capacitor value is given by the following equations:

$$C_{tune} = \frac{2}{(2\pi \cdot 13.56 \text{ MHz})^2 \cdot L_{ant}} - C_p - C_{int}$$

An antenna inductance of $L_{ant} = 0.72 \mu\text{H}$ provides tuning capacitors in the range of 300 pF on each pin. The total capacitance on NFC1 and NFC2 must be matched. C_{int} and C_p are small usually (C_{int} is 4pF), so can omit from calculation.

Battery Protection Note: If the NFC coil antenna is exposed to a strong NFC field, the supply current may flow in the opposite direction due to parasitic diodes and ESD structures.

If the used battery does not tolerate a return current, a series diode must be placed between the battery and the BL5340PA to protect the battery.

For more details, see the [NFC flex PCB antenna \(Laird 0600-0061\) datasheet](#):

5.3 UARTE – Universal asynchronous receiver/transmitter with Easy DMA

The nRF5340 has 4 UARTs (with flow control CTS, RTS) on the Application Core and 1 UART (with flow control CTS, RTS) On the Network Core. Can be brought out on any GPIO pins. UARTE features:

- Full duplex operation
- Automatic hardware flow control
- Optional even parity bit checking and generation
- Easy DMA (for reading and writing to and from RAM)
- Upto 1Mbps baud rate. Baud rate accuracy depends on HFCLK source selected.
- Return to IDLE between transactions supported (when using HW flow control)
- One or two stop bits
- Least significant bit (LSB) first
- UART's can be brought out on any GPIOs and independently configurable.

The signaling levels are nominal 0 V and 3.3 V (tracks VDD) and are inverted with respect to the signaling on an RS232 cable.

Two-way hardware flow control is implemented by UART_RTS and UART_CTS. UART_RTS is an output and UART_CTS is an input. Both are active low.

These signals operate according to normal industry convention. UART_RX, UART_TX, UART_CTS, UART_RTS are all 3.3 V level logic (tracks VDD). For example, when RX and TX are idle, they sit at 3.3 V (tracks VDD). Conversely for handshaking pins CTS, RTS at 0 V is treated as an assertion.

The module communicates with the customer application using the following signals:

- Port/TxD of the application sends data to the module's UART_RX signal line
- Port/RxD of the application receives data from the module's UART_TX signal line

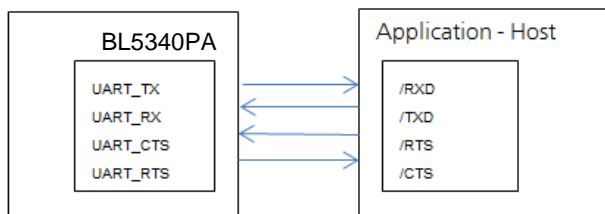


Figure 9: UART signals

Note: The BL5340PA serial module output is at CMOS logic levels (tracks VDD). Level convertor must be added to interface with an RS-232 level compliant interface.

Some serial implementations link CTS and RTS to remove the need for handshaking. We do not recommend linking CTS and RTS other than for testing and prototyping. If these pins are linked and the host sends data at the point that the BL5340PA deasserts its RTS signal, there is significant risk that internal receive buffers will overflow, which could lead to an internal processor crash. This will drop the connection and may require a power cycle to reset the module. We recommend you adhere to the correct CTS/RTS handshaking protocol for proper operation.

Table 11: GPIO used on DVK-BL5340PA to bring out UART0 and UART1 interfaces

| Signal Name | Pin No | I/O | Comments |
|-------------|--------|-----|----------|
|-------------|--------|-----|----------|

| | | | |
|-------------------|----|---|--|
| P0.20 / UART0_TX | 14 | O | P0.20 (alternative function UART0_TX) is an output, set high (in firmware). Application Core. |
| P0.22 / UART0_RX | 12 | I | GPIO_08 (alternative function UART0_RX) is an input, set with internal pull-up (in firmware). Application Core. |
| P0.19 / UART0_RTS | 15 | O | P0.19 (alternative function UART0_RTS) is an output, set low (in firmware). Application Core. |
| P0.21 / UART0_CTS | 11 | I | P0.21 (alternative function UART0_CTS) is an input, set with internal pull-down (in firmware). Application Core. |
| P1.08 / UART1_TX | 7 | O | P1.08 (alternative function UART1_TX) is an output, set high (in firmware). Network Core. |
| P1.10 / UART1_RX | 57 | I | P1.10 (alternative function UART1_RX) is an input, set with internal pull-up (in firmware). Network Core. |
| P1.07 / UART1_RTS | 8 | O | P1.07 (alternative function UART1_RTS) is an output, set low (in firmware). Network Core. |
| P1.09 / UART1_CTS | 5 | I | P1.09 (alternative function UART1_CTS) is an input, set with internal pull-down (in firmware). Network Core. |

The GPIO pins in Table 11 are used for UART0 and UART1 interface as assigned for DVK-BL5340PA dev board. UART's can be brought out on any GPIO pin on BL5340PA module.

Baud rate accuracy depends on HFCLK source selected.

High baud rates may require GPIOs to be set as High Drive.

5.4 USB D – Universal Serial Bus device

BL5340PA has USB2.0 FS (Full Speed, 12Mbps) hardware capability.

Table 12: USB interface

| Signal Name | Pin No | I/O | Comments |
|-------------|--------|-----|---|
| D- | 42 | I/O | |
| D+ | 36 | I/O | |
| VBUS | 40 | | <p>To use the BL5340PA USB peripheral:</p> <ol style="list-style-type: none"> 1) Connect the BL5340PA VBUS pin to the external supply within the range 4.35V to 5.5V. When using the BL5340PA VBUS pin, you MUST externally fit a 4.7uF to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized. 2) Connect the external supply to both VDD and VDD_HV to operate the rest of BL5340PA module in Normal Voltage mode. <p>An optional series 4.7Ohms resistor on the USB supply (VBUS) can be fitted for improved immunity to transient over-voltage VBUS connection.</p> <p>If not using USB peripheral, the VBUS pin can be left unconnected.</p> |

5.5 SPI Master – Serial Peripheral Interface master

The nRF5340 supports 4 x SPI master/slave interface (SPIM /SPIS) with easy DMA (on Application Core) and 1 x SPIM master/slave with easy DMA (on Network Core). For this any GPIO pin can be used.

The nRF5340 supports 1 x High Speed SPI master/slave interface (SPIM4) for the fastest SPIM mode (32Mbps) on the Application Core (when running at 128MHz), For SPIM4, dedicated GPIO pins must be used (see [Table 13](#)). SPIM4 supports Easy DMA direct transfer to and from RAM.

The SPIM interface enables full duplex synchronous communication between devices. It supports a 3-wire (SPI_MOSI, SPI_MISO, SPI_SCK,) bidirectional bus with fast data transfers to and from multiple slaves and optional D/CX output line for distinguishing between command and data bytes. Individual chip select signals are necessary for each of the slave devices attached to a bus, but control of these is left to the application.

The SPI peripheral supports SPI mode 0, 1, 2, and 3.

Table 13: High Speed SPI (SPIM4 32Mbps) interface dedicated pins

| Signal Name | Pin No | I/O | Comments |
|------------------|--------|-----|---|
| P0.08/SPIM4_SCK | 27 | O | These dedicated GPIO pins must be used for 32Mbps high speed SPI using SPIM4, and drive strength configuration H0H1 must be used. |
| P0.09/SPIM4_MOSI | 25 | O | |
| P0.10/SPIM4_MISO | 22 | I | |
| P0.11/SPIM4_CSN | 23 | O | |
| P0.12/SPIM4_DCX | 20 | O | |

SPI Master (SPIM) maximum bit rate is 16Mbps and this may require GPIO to be set as High Drive strength. Other SPIM bit rates are 8Mbps, 4Mbps, 2Mbps, 1Mbps, 500kbps, 250kbps, 125kbps (and accuracy depends on HFCLK source selected).

High Speed SPIM (SPIM4) is 32Mbps and requires to dedicated GPIO pins (Application core when running at 128MHz). For other lower speed SPI, any GPIO pins can be used.

To secure correct behavior in the pins used by SPIM must be configured in the GPIO peripheral before enabling the SPI slave.

5.6 SPI Slave – Serial Peripheral Interface slave

The nRF5340 supports 4 x SPI master/slave interface (SPIM /SPIS) with easy DMA (on Application Core) and 1 x SPIM master/slave with easy DMA (on Network Core). For this any GPIO pin can be used.

SPI slave (SPIS) is implemented for ultra-low power communication from an external SPI master. Easy DMA in conjunction with hardware-based semaphore mechanism removes all real time requirements associated with controlling SPI slave from a low priority CPU execution context.

Maximum SPIS bit rate is 8Mbps and the actual maximum data rate depends on the masters CLK to MISO setup and hold timings. Also, this higher SPIS bit rate requires GPIO to be set as High Drive strength.

The MISO line is set in high impedance as long as the SPI slave is not selected with CSN.

To secure correct behavior in the salve SPI slave, the pins used by the SPI slave must be configured in the GPIO peripheral before enabling the SPI slave.

5.7 QSPI – Quad Serial Peripheral interface

The nRF5340 supports 1 x QSPI interface peripheral (on Application Core) for communicating with external flash memory device. The main features for QSPI peripheral are:-

- Single/dual/quad SPI input/output
- 6 to 96MHz configurable clock frequency
- Single-word read/write access from/to external flash
- Easy DMA for block read and write transfers
- Up to 48MB/sec Easy DMA read rate
- Execute in place (SIP) for executing program directly from external flash
- XIP (Execute in Place) access can be optional be disabled
- On-the-fly encryption and decryption including Easy DMA and XIP

For QSPI only the dedicated GPIO pins from [Table 14](#) shall be used.

Table 14: QSPI Interface dedicated pins

| Signal Name | Pin No | I/O | Comments |
|----------------|--------|-----|----------|
| P0.13/QSPI_IO0 | 24 | IO | |

| | | | |
|----------------|----|----|--|
| P0.14/QSPI_IO1 | 62 | IO | For QSPI only these dedicated GPIO pins must be used. The GPIO must use the high drive H0H1 (High 0 High 1) configuration. H0H1 is to do with slew rate. |
| P0.15/QSPI_IO2 | 18 | IO | |
| P0.16/QSPI_IO3 | 17 | IO | |
| P0.17/QSPI_CLK | 16 | O | |
| P0.18/QSPI_CSN | 61 | O | |

For all high-speed signal, the printed circuit board (PCB) layout must ensure that connections are made using short PCB traces.

5.8 TWIM – I2C compatible 2-wire interface master

The nRF5340 supports 4 x TWI peripheral (on Application Core and 1 x TWI (on Network Core). The TWI master with Easy DMA (TWIM) is two wire half duplex master which can communicate with multiple slave devices to same bus. Main features of TWIM:

- I2C compatible
- Supported baud rates: 100, 250, 400 and 1000kbps. High bit rates or stronger pull-ups may require GPIOs set as High drive.
- High Speed TWI (1Mbps) is available on dedicated GPIO pins only)
- Support for clock stretching (non I2C compliant)
- EasyDMA

An I2C interface allows multiple masters and slaves to communicate over a shared wired-AND type bus consisting of two lines which normally sit at VDD. The SCL is the clock line which is always sourced by the master and SDA is a bi-directional data line which can be driven by any device on the bus. The protocol makes it possible to interconnect up to 127 individually addressable devices. TWIM is not compatible with CBUS.

IMPORTANT: It is essential to remember that pull-up resistors on both SCL and SDA lines are required. The value of the nRF5340 pull up resistor is 13K Ohms typical. For other values, fit external pull-up resistor on both SCL and SDA as per I2C specification to set speed. The I2C specification allows a line capacitance of 400pF.

Table 15: High speed TWIM (1Mbps) interface dedicated GPIO pins for proper operation

| Signal Name | Pin No | I/O | Comments |
|---------------|--------|-----|--|
| P1.02/I2C_SDA | 37 | I/O | For the fastest TWI 1Mbps mode, the two dedicated high speed TWI pins must be configured and the 20mA open drain driver enabled using the E0E1 drive configuration. For the dedicated, high-speed TWIM pins on P1.02 and P1.03, the E0E1 drive configuration activates a powerful 20 mA open-drain driver specifically designed for high-speed TWI. |
| P1.03/I2C_SCL | 38 | I/O | |

The GPIOs used for each two-wire interface can be chosen from any GPIO device and are independently configurable. This enables great flexibility in device pinout and efficient use of Printed Circuit Board space and signal routing.

To secure correct signal levels on the pins used for TWIM while is System OFF mode and when TWIM is disabled, the pins must be configured as in [Table 16](#).

Table 16: GPIO configuration before entering peripheral TWIM or TWIS

| Signal Name | Pin No | I/O | Output value | Drive strength |
|-------------|--------------------------|-----|----------------|--------------------------------|
| I2C_SDA | As specified in PSEL.SCL | I | Not applicable | S0D1 (Standard 0 Disconnect 1) |
| I2C_SCL | As specified in PSEL.SDA | I | Not applicable | S0D1 (Standard 0 Disconnect 1) |

5.9 TWIS – I2C compatible 2-wire interface master

TWI slave with EasyDMA (TWIS) is a two-wire half-duplex slave which can communicate with a master device connected to the same bus. Main features for TWIS:

- I2C compatible

- Supported baud rates: 100 and 400 kbps
- EasyDMA

To ensure lowest possible power consumption when the peripheral is not needed stop and disable TWIS.

5.10 GPIO – General Purpose Input /Output

The BL5340PA has 40 general purpose input /output pins (GPIO) are grouped as 2 ports, P0 port has 28 GPIOs and P1 port has 12 GPIOs. They can be accessed individually. Each has the following user configured features:

- Input/output direction
- Output drive strength (standard drive 0.5 mA or high drive 3mA, 5mA)
- Internal pull-up and pull-down resistors (13 K typical) or no pull-up/down or input buffer disconnect
- Wake-up from high or low-level triggers on all pins including NFC pins (Low power detection of pin state changes is possible when in System ON or System OFF)
- Trigger interrupt on state change on any pin (rising edge, falling edge, any change)

Note: When a pin is configured as digital input, care has been taken to minimize increased current consumption when the input voltage is between V_{IL} and V_{IH} . However, it is a good practice to ensure that the external circuitry does not drive that pin to levels between V_{IL} and V_{IH} for a long period of time.

There are additional 8 GPIO's that are connected used to control FEM (nRF21540) inside the BL5340.

5.11 SAADC – Successive approximation analog-to-digital convertor

The nRF5340 has differential successive approximation register analog to digital convertor (SAADC). Main features of SAADC:

- SAADC on Application Core
- 8/10/12-bit resolution and 14-bit resolution with oversampling
- Multiple analog inputs:
 - AIN0 to AIN3, AIN5 to AIN7 pins
 - VDD pin
 - VDDHDIV5 (through VDDH pin)
- 8 input channels:
 - One channel per singled ended input and two channels per differential input
 - Scan mode can be configured with both single ended channels and differential channels
 - Each channel can be configured to select any of the above analog inputs
- Full scale input range (0 to VDD)
- Sampling triggered via a task from software or a PPI channel for full flexibility on sample frequency source from low power 32.768kHz RTC or more accurate 1/16MHz timers
- One-shot conversion mode to sample a single channel
- Scan mode to sample a series of channels in sequence with configurable sample delay
- Support for direct sample transfer to RAM using Easy DMA
- Interrupts on single sample and full buffer events
- Sample stored as 16-bit two's compliment values for differential and single ended sampling
- Continuous sampling without the need of an external timer
- Internal resistor string
- On-the-fly limit checking

The ADC can coexist with COMP and other peripherals using one of the AIN0-AIN7 provided these are assigned to different pins. It is not recommended to select the same analog input for both modules.

BL5340PA provides access to 7-channel 8/10/12-bit successive approximation ADC in one-shot mode. This enables sampling up to 7 external signals through a front-end MUX. The ADC has configurable input and reference pre-scaling and sample resolution (8, 10, and 12 bit).

Table 17: Analog interface on dedicated pins

| Signal Name | Pin No | I/O | Comments |
|-------------|--------|-----|----------|
|-------------|--------|-----|----------|

| | | | |
|--|----|----|---|
| NC (was P0.04/AIN0 – Analog Input on BL5340) | 63 | NC | This interface is an alternate function on each pin, configurable. Configurable 8, 10, 12-bit resolution. |
| P0.05/AIN1 – Analog Input | 46 | I | 14-bit resolution with oversampling |
| P0.06/AIN2 – Analog Input | 64 | I | Eight 8/10/12-bit channels on AIN0-AIN7 or VDD or VDDH/5 |
| P0.07/AIN3 – Analog Input | 65 | I | Configurable reference internal reference 0.6V or external reference VDD/4 |
| P0.25/AIN4 – Analog Input | 6 | I | Configurable pre-scaling of 4, 2, 1, 1/2, 1/3, 1/4, 1/5 1/6 |
| P0.26/AIN5 – Analog Input | 2 | I | Configurable acquisition time 3uS, 5uS, 10uS, 15uS, 20uS, 40uS. |
| P0.27/AIN6 – Analog Input | 4 | I | One-shot mode or Burst mode |
| P0.28/AIN7 – Analog Input | 53 | I | Scan mode for multiple channels |
| | | | Single ended or Differential or not connected |

5.12 COMP – Comparator

The comparator (COMP) compares an input voltage (VIN+) against a second input voltage (VIN-). VIN+ can be derived from an analog input pin (AIN0-AIN3 and AIN5-AIN7). VIN- can be derived from multiple sources depending on the operation mode of the comparator.

COMP features include:

- Input range from 0V to VDD
- Single-ended mode
 - Fully flexible hysteresis using 64-level reference ladder
- Differential mode
 - Configurable hysteresis
- Reference input (VREF)
 - VDD
 - External reference from AIN0 to AIN7 (between 0V to VDD)
- Three speed/power consumption modes:
 - Low power
 - Normal
 - High speed
- Single pin capacitive sensor support
- Event generation on output changes

5.13 LPCOMP – Low power comparator

Low Power comparator (LPCOMP) compares an input voltage against reference voltage.

LPCOMP features include:

- 0V – VDD input range
- Ultra low power
- Seven input options (AIN0 to AIN3 and AIN5 to AIN7)
- Reference voltage options:
 - Two external analog reference inputs, or
 - 15-level internal reference ladder (VDD/16)
- Optional hysteresis-enable on input
- Can be used as a wakeup source from SYSTEM OFF mode

5.14 PWM – Pulse Width Modulation

The pulse width modulation (PWM) module allows the generation of PWM signals on GPIO. The module implements an up or up and-and-down counter with 4 x PWM channels (on Application Core) that drive assigned 4 x GPIOs. There are 4 x PWM units with Easy DMA.

PWM features include:

<https://www.lairdconnect.com/bl5340pa-series>

- Programmable PWM frequency
 - Prescaler of PWM_CLK: divide by 1(16MHz), divide by 2(8MHz), divide by 4(4MHz), divide by 8(2MHz), divide by 16(1MHz), divide by 32(500kHz), divide by 64(250kHz), divide by 128(125kHz)
- Up to four PWM channels with individual polarity and duty cycle values
- Edge or center-aligned pulses across PWN channels
- Multiple duty cycle arrays (sequences) defined in RAM
- Autonomous and glitch-free update of duty cycle values directly from memory through Easy DMA (no CPU involvement)
- Change of polarity, duty cycle and base frequency possibly on every PWM period
- RAM sequences can be repeated or connected into loops.

The **PWM output** signal has a frequency and duty cycle property. Frequency is adjustable (up to 16 MHz) and the duty cycle can be set over a range from 0% to 100%.

There is a trade-off between PWM output frequency and resolution.

For example:

- PWM output frequency of 500 kHz (2 uS) results in resolution of 1:2.
- PWM output frequency of 100 kHz (10 uS) results in resolution of 1:10.
- PWM output frequency of 10 kHz (100 uS) results in resolution of 1:100.
- PWM output frequency of 1 kHz (1000 uS) results in resolution of 1:1000.

5.15 TIMER – Timer/counter

There are 3 x 32-bit TIMER peripheral with counter mode (on Application Core and Network Core) and is a general-purpose timer allowing time intervals to be defined by user input. It can operate in two modes (Timer mode and Counter mode).

TIMER runs on HFCLK source and includes 4-bit (1/2X) prescaler that can divide the timer input clock from the HFCLK controller. TIMER base frequency is always 16MHz divided by the prescaler value.

In Timer mode, TIMER's internal counter register is incremented by one for every tick of the timer frequency f_{TIMER} . The timer frequency is derived from PCLK16M and using value specified in the prescaler register.

$$f_{TIMER} = 16MHz / (2^{PRESCALAR})$$

When $f_{TIMER} \leq 1MHz$, TIMER uses PCLK1M instead of PCLK16M for reduced power consumption.

In Counter mode, the timer frequency and prescaler are not utilized but the TIMER's internal counter register is incremented by one each time the COUNT Task is triggered.

5.16 RTC – Real Timer Counter

There are 2 x 24-bit real timer counter (RTC) on Application Core and 2 x RTC on Network Core. The real time counter (RTC) module provides a generic, low power timer on the low frequency clock source (LFCLK). When started, the RTC will automatically request LFCLK source with RC oscillator if the LFCLK is not already running.

5.17 TEMP – Temperature sensor

TEMP sensor in the Network Core.

Main features of TEMP are:

- Temperature range is greater than or equal to operating temperature range of nRF5340 device
- Resolution is 0.25°C degrees
- The on-silicon temperature sensor accuracy is $\pm 5^\circ C$ (for TEMP sensor range $-20^\circ C$ to $+70^\circ C$)
- The on-silicon temperature sensor accuracy is $\pm 7^\circ C$ (for TEMP sensor range $-40^\circ C$ to $+105^\circ C$)
- To achieve the measurement accuracy stated, the crystal oscillator must be selected as the HFCLK source
- When the temperature measurement is completed, TEMP analog electronics power down to save power
- TEMP only supports one-shot operation, meaning that every TEMP measurement must be explicitly started
- Time required for temperature measurement 36us typical
- Linearity compensation can be implemented if required by the application

5.18 Security/Privacy

nRF5340 contains Arm TrustZone CryptoCell™ -312 security subsystem on the Application Core:

- NIST 800-90B, AIS-31, and FIPS 140-2 compliant random number generator
- AES-128 and 256: ECB, CBC, CMAC/CBC-MAC, CTR, CCM/CCM*, GCM
- SHA-1, SHA-2 up to 256 bits
- Keyed-hash message authentication code (HMAC)
- RSA public key cryptography with up to 3072-bit key size
- ECC support for most used curves
- Application key management using derived key model

5.19 RNG – Random number generator

The Network Core has 1 x Random Number Generator (RNG) that generates true non-deterministic random numbers based on internal thermal noise that are suitable for cryptographic purposes. The RNG does not require a seed value.

5.20 I2S – Inter-IC sound interface

The I2S (Inter-IC-Sound Interface) module supports the original two channel I2S format and left or right aligned formats. It implements EasyDMA for sample transfer directly to and from RAM without CPU intervention.

The I2S peripheral main features include:

- Master and Slave mode
- Simultaneous bidirectional (TX and RX) audio streaming
- Original I2S and left or right aligned format
- 32, 24, 16, 8-bit sample width
- Separate sample and word widths
- Low-jitter master clock generator
- Various sample rates

The MCK, SCK, LRCK, SDIN and SDOUT signals associated with the I2S module are mapped to GPIO pins selected when the I2S module is enabled. When a pin is acquired by the I2S module, the direction of the pin (input or output) will be configured automatically and any pin direction setting done in the GPIO module will be overwritten. The directions for the I2S pins is shown in [Table 18](#) and [Table 19](#) below.

To secure correct signal levels on the pins in System OFF mode and when I2S module is disabled, these pins must be configured in the GPIO peripheral directly.

Table 18: I2S Master interface signals before enabling peripheral

| Signal Name | Pin No | I/O | Output value | Comments |
|-------------|----------|-----|----------------|------------|
| MCK | Any GPIO | O | 0 | I2S master |
| LRCK | Any GPIO | O | 0 | |
| SCK | Any GPIO | O | 0 | |
| SDIN | Any GPIO | I | Not applicable | |
| SDOUT | Any GPIO | O | 0 | |

Table 19: I2S Slave interface signals before enabling peripheral

| Signal Name | Pin No | I/O | Output value | Comments |
|-------------|----------|-----|----------------|-----------|
| MCK | Any GPIO | O | 0 | I2S slave |
| LRCK | Any GPIO | I | Not applicable | |
| SCK | Any GPIO | I | Not applicable | |
| SDIN | Any GPIO | I | Not applicable | |

SDOUT Any GPIO O 0

5.21 PDM – Pulse Density Modulation interface and digital microphones

The pulse density modulation (PDM) module enables input of PDM signals from external audio frontends, such as digital microphones. The PDM peripheral generates the PDM clock and supports single or dual channel (left and right) data input. Data is transferred directly to RAM buffers using EasyDMA.

The PDM peripheral main features include:

- Up to two PDM microphones configured as left/right pair using the same data input
- 16 kHz output sample rate, 16-bit samples
- EasyDMA support for sample buffering
- HW decimation filters
- Selectable ratio of 64 or 80 between PDM_CLK and output sample rate

Table 20: PDM interface signals

| Signal Name | Pin No | I/O | Comments |
|-------------|----------|-----|---------------------|
| DIN | Any GPIO | I | In Application Core |
| CLK | Any GPIO | O | |

PDM can be configured with a single microphone (mono), or with two microphones. When a single microphone is used, connect the microphone clock to CLK, and data to DIN.

If two microphones are used, one of them has to be set as left, the other as right (L/R pin tied high or to GND on the respective microphone). It is strongly recommended to use two microphones of exactly the same brand and type so that their timings in left and right operation match.

To ensure correct operation in the PDM module, the pins used by PDM module must be configured in the GPIO peripheral before enabling the PDM module. This is to ensure that the pins used by the PDM module are driven correctly if the PDM module itself is temporarily disabled or the device temporarily enters System OFF. This configuration must be retained in the GPIO for the selected I/O's as long as the PDM module is supposed to be connected to an external PDM circuit. Only one peripheral can be assigned to drive a particular GPIO pin at a time. Failing to do so may result in unpredictable behavior.

5.22 QDEC – Quadrature decoder

The Quadrature decoder (QDEC) provides buffered decoding of quadrature encoded sensor signals. It is suitable for mechanical and optical sensors. QDEC is a 3-pin interface to the off-module quadrature encoder. There are 2 x QDEC in the Application Core.

The QDEC main features include:

- Sample period and accumulation are configurable to match application requirements
- Decoding of digital waveform from off-chip quadrature encoder
- Sample accumulation eliminating hard real time requirements to be enforced on application
- Optional input debounce filters
- Optional LED output signal for optical encoders

To secure correct behavior in the QDEC the pins used by the QDEC must be configured in the GPIO peripheral as shown in [Table 21](#) before enabling the QDEC. Only one peripheral can be assigned to drive a particular GPIO pin at a time. Failing to do so may result in unpredictable behavior.

Table 21: QDEC interface signals before enabling peripheral

| Signal Name | Pin No | I/O | Output value | Comments |
|-------------|----------|-----|----------------|----------|
| Phase A | Any GPIO | I | Not applicable | |
| Phase B | Any GPIO | I | Not applicable | |
| LED | Any GPIO | I | Not applicable | |

5.23 nRESET – pin reset

Table 22: nRESET pin

| Signal Name | Pin No | I/O | Comments |
|-------------|--------|-----|--|
| nRESET | 54 | I | BL5340PA HW reset (active low). The reset pin must be held low (for 0.2uS TBC) to generate a valid reset. Reset time when using pin reset, depending on pin capacitance. 500nF capacitance on reset pin: 13mS (Typ), 40mS (max), 10uF capacitance on reset pin: 260mS (Typ), 800mS (max), e.g., approximately $t=5RC$ where R is the internal pullup 13K Ohms typical enabled. |

A reset in the system is triggered by either a system level or core level reset source. A system level reset will reset all cores. Examples of system level reset are Power-on reset, brownout reset and pin reset. Examples of core level reset are soft reset or lockup will reset either entire core or only part of it. Refer to the nRF5340 datasheet for more details
https://infocenter.nordicsemi.com/topic/ps_nrf5340/keyfeatures_html5.html?cp=3_0_0

5.24 SWD – Two-wire interface

It is mandatory for the customer to wire out the BL5340PA SWD two-wire serial interface on host design for purposes of programming firmware and debug. See Figure 10 where the following four lines should be wired out: SWDIO, SWDCLK, GND and VDD).

SWO (P0.11) is a Trace output (called SWO, Serial Wire Output) and is not necessary for programming BL5340PA over the SWD interface.

nRESET_BLE is necessary for programming BL5340PA over the SWD interface.

Table 23: Signals for Firmware and Debug

| Signal Name | Pin No | I/O | Comments |
|-------------|--------|-----|-----------------------------------|
| SWDIO | 55 | I/O | Internal pull-up resistor (13K) |
| SWDCLK | 56 | I | Internal pull-down resistor (13K) |
| nRESET | 54 | I | Internal pull-up resistor (13K) |
| GND | | | |
| VDD | | | |

The Laird Connectivity development board incorporates an on-board USB-to SWD J-link programmer for this purpose.

The SWD connector MPN is as follows:

Table 24: SWD Connector MPN

| Reference | Part | Description and MPN (Manufacturers Part Number) |
|-----------|----------|---|
| P1 | FTSH-105 | Header, 1.27mm, SMD, 10-way, FTSH-105-01-L-DV Samtech |

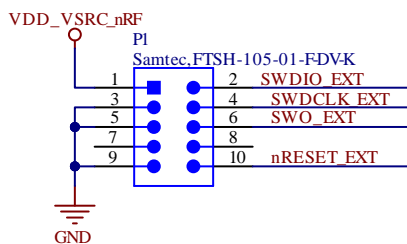


Figure 10: SWD BL5340PA development board schematic

5.25 Peripheral Block Current Consumption

The values below are calculated for a typical operating voltage of 3V (Normal voltage mode).

Table 25: Common conditions of 3V operating voltage

| Condition | Value | Note |
|-------------------------|--|---|
| Supply | 3V on VDD/VDD_HV(Normal voltage mode) | |
| Temperature | 25°C | |
| CPU | (WFI(wait for interrupt)/WFE(wait for event) sleep | |
| Peripherals | All idle | |
| Clock | HFCLK = HFINT @64MHz, LFCLK=not running | |
| Regulator | DCDC ON for VREGMAIN, VREGRADIO and VREGH (when used) | |
| Application core RAM | 8kB | In System ON, RAM value refers to the amount of RAM that is switched on. The remainder of RAM is non retained. In System OFF, RAM value refers to amount of RAM that is retained. |
| Application core RAM | 0kB | |
| Cache enabled | Yes | Only applies when the CPU is running from flash memory. |
| Network core Forced off | yes | |
| 32MHz crystal | yes | Only applies when the high frequency crystal oscillator (HFXO) is running. HFXO is used when the radio is running |
| 32.768kHz crystal | yes | Only applies when the low frequency crystal oscillator (LFXO) is running. |

Table 26: UART power consumption

| Parameter | Min | Typ | | Max | Unit |
|--|-----|-----------|----------|------|------|
| | | WITH DCDC | WITH LDO | | |
| UARTE RX idle (started, waiting for data, no data transfer) | - | 645 | - | - | uA |
| UARTE RX idle (started, waiting for data, no data transfer), clock=HFXO64M | - | 840 | - | - | uA |
| UART transferring data @ 1200 bps clock=HFXO64M | - | 885 | - | - | uA |
| UART transferring data @ 115200 bps clock=HFXO64M | - | 890 | - | - | uA |
| UART receiving data @ 115200 bps clock=HFXO64M | - | 890 | - | - | uA |
| UART transmitting and receiving data @ 115200 bps clock=HFXO64M | - | 895 | - | - | uA |
| UART Baud rate | 1 | - | - | 1000 | kbps |

Table 27: SPIM and SPIS power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| SPI Master transferring data @ 2 Mbps | - | 935 | - | - | uA |
| SPI Master transferring data @ 2 Mbps, clock=HFXO64M | - | 1145 | - | - | uA |
| SPI Master transferring data @ 8 Mbps | - | 1705 | - | - | uA |
| SPI Master transferring data @ 8 Mbps, clock=HFXO64M | - | 1930 | - | - | uA |
| SPI Master transferring data @ 32 Mbps | - | 2115 | - | - | uA |
| SPI Master transferring data @ 32 Mbps, clock=HFXO64M | - | 2345 | - | - | uA |
| SPIS configured and idle (enabled, no CSN activity) | - | 145 | - | - | uA |
| SPIS transferring data @ 2Mbps | - | 713 | - | - | uA |
| SPIS transferring data @ 2 Mbps, clock=HFXO64M | - | 913 | - | - | uA |

Table 28: TWIM and TWIS (I2C) power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| TWIM transferring data @100kbps | - | 965 | - | - | uA |
| TWIM transferring data @100kbps, clock=HFXO64M | - | 1170 | - | - | uA |
| TWIM transferring data @400kbps | - | 1000 | - | - | uA |
| TWIM transferring data @400kbps, clock=HFXO64M | - | 1250 | - | - | uA |
| TWIM transferring data @1000kbps | - | 2050 | - | - | uA |
| TWIM transferring data @1000kbps, clock=HFXO64M | - | 2295 | - | - | uA |
| TWIS configured and enabled (IDLE state) | - | 45 | - | - | uA |
| TWIS transferring data @100kbps | - | 945 | - | - | uA |
| TWIS transferring data @400kbps | - | 985 | - | - | uA |
| TWIS transferring data @100kbps, clock=HFXO64M | - | 1150 | - | - | uA |
| TWIS transferring data @400kbps, clock=HFXO64M | - | 1185 | - | - | uA |

Table 29: ADC power consumption

| Parameter | Min | Typ | | Max | Unit |
|--|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| ADC current during conversion SAADC sampling @16ksps, acquisition time =20uS, clock HFXO | - | 980 | - | - | uA |
| SAADC sampling @1kHz from RTC intask mode, LPOP=Lowlat, acquisition time =20uS, clock HFINT64M and LFXO | - | 770 | - | - | uA |
| SAADC sampling @1kHz from RTC in task mode, LPOP=LowPower, acquisition time =20uS, clock HFINT64M and LFXO | - | 160 | - | - | uA |

Table 30: COMP and LCOMP power consumption

| Parameter | Min | Typ | | Max | Unit |
|---------------------------------|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| COMP enabled, Low power mode | - | 60 | - | - | uA |
| COMP enabled, normal power mode | - | 62 | - | - | uA |
| COMP enabled, High power mode | - | 68 | - | - | uA |
| LCOMP enabled | - | 45 | - | - | uA |

Table 31: QSPI power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| QSPI idle (enabled, but not activated) | - | 45 | - | - | uA |
| QSPI active (activated, but not transferring data) | - | 1790 | - | - | uA |
| QSPI active (activated and transferring data to /from external flash memory), SCKFREQ=96MHz, quad mode, clock=HF XO192M | - | 4430 | - | - | uA |

Table 32: NFC power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| System ON, current in SENSE STATE (this current does not apply when in NFC field) | - | 1.3 | - | - | uA |
| System ON, current in ACTIVATED STATE, clock=HF XO64M | - | 1080 | - | - | uA |

Table 33: PWM power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| PWM running at 125kHz, top=10, duty=50% | - | 560 | - | - | uA |
| PWM running at 16MHz, top=10, duty=50% | - | 560 | 1035 | - | uA |
| PWM running at 125kHz, top=10, duty=50%, clock=HF XO64M | - | 750 | - | - | uA |
| PWM running at 16MHz, top=10, duty=50%, clock=HF XO64M | - | 755 | - | - | uA |

Table 34: TIMER power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| One TIMER running @1MHz | - | 475 | - | - | uA |
| One TIMER running @1MHz, clock=HF XO64M | - | 670 | - | - | uA |
| One TIMER running @16MHz | - | 560 | 1040 | - | uA |
| One TIMER running @16MHz, clock=HF XO64M | - | 750 | 1280 | - | uA |
| One TIMER running @16MHz, clock=HF INT28M | - | 750 | - | - | uA |
| One network TIMER running @1MHz | - | 170 | - | - | uA |
| One network TIMER running @1MHz, clock=HF XO64M | - | 400 | - | - | uA |
| One network TIMER running @16MHz | - | 220 | - | - | uA |

Table 35: WDT power consumption

| Parameter | Min | Typ | | Max | Unit |
|---------------------------------------|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| Application MCU WDT started | - | 2.0 | 4.9 | - | uA |
| Network MCU started, 64kB network RAM | - | 3.2 | - | - | uA |

Table 36: TEMP Power Consumption

| Parameter | Min | Typ | | Max | Unit |
|--------------------------------|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| TEMP started, 64kB network RAM | - | 615 | - | - | uA |

Table 37: RNG power consumption

| Parameter | Min | Typ | | Max | Unit |
|-------------------------------|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| RNG running, 64kB network RAM | - | 270 | - | - | uA |

Table 38: QDEC power consumption

| Parameter | Min | Typ | | Max | Unit |
|--------------|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| QDEC running | - | 460 | - | - | uA |

Table 39: PDM power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| PDM receiving and processing data @ 1Msps (RATIO=64, PDMCLKCTRL=135274496), stereo mode, clock=HFXO64M | - | 655 | - | - | uA |
| PDM receiving and processing data @ 1Msps (RATIO=64, PDMCLKCTRL=3435997056), stereo mode, clock=HFXO64M | - | 1045 | - | - | uA |

Table 40: I2S power consumption

| Parameter | Min | Typ | | Max | Unit |
|---|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| I2S transferring data @ 2x16bitx16kHz (CONFIG.MCKFREQ=32MDIV63, CONFIG.RATIO=32X), clock=HFXO64M | - | 2000 | - | - | uA |
| I2S transferring data @ 2x16bitx16kHz (CONFIG.MCKFREQ=510000, CONFIG.RATIO=32X), clock=HFXO ACLK@12.288MHz | - | 2170 | - | - | uA |
| I2S transferring data @ 2x16bitx48kHz (CONFIG.MCKFREQ=505286656, CONFIG.RATIO=32X), clock=HFXO ACLK@12.288MHz | - | 2310 | - | - | uA |

Table 41: USB active power consumption

| Parameter | Min | Typ | | Max | Unit |
|--|-----|-----------|----------|-----|------|
| | | WITH DCDC | WITH LDO | | |
| Current from VBUS supply, USB active | - | 1.2 | - | - | uA |
| Current from VBUS supply, USB suspended, CPU sleeping | - | 180 | - | - | uA |
| Current from VDD supply (normal voltage mode), all RAM retained, CPU running, USB active | - | 3.0 | - | - | uA |
| Current from VDD supply (normal voltage mode), all RAM retained, CPU running, USB suspended | - | 815 | - | - | uA |
| Current from VDD supply (normal voltage mode), all RAM retained, CPU sleeping, USB suspended, regulator = LDO | - | 135 | - | - | uA |
| Current from VDDH supply (high voltage mode), VDD=3 V (VREGH output), all RAM retained, CPU running, USB active | - | 3.2 | - | - | uA |
| Current from VDDH supply (high voltage mode), VDD=3 V (VREGH output), all RAM retained, CPU sleeping, USB suspended | - | 2340 | - | - | uA |
| Current from VDDH supply (high voltage mode), VDD=3 V (VREGH output), all RAM retained, CPU sleeping, USB suspended, regulator = LDO | - | 125 | - | - | uA |
| Current from VDD supply, USB disabled, VBUS supply connected, all RAM retained, CPU sleeping | - | 3 | - | - | uA |

The above current consumption is for the given peripheral including the internal blocks that are needed for that peripheral for both the case when DCDC is on and off. The peripheral Idle current is when the peripheral is enabled but not running (not sending data or being used) and must be added to the System ON Idle current. In all cases radio is not turned on.

For asynchronous interface, like the UART (asynchronous as the other end can communicate at any time), the UART on the BL5340PA must be kept open, resulting in the base current consumption penalty.

For a synchronous interface like the I2C or SPI (since BL5340PA side is the master), the interface can be closed and opened when needed, resulting in current saving (no base current consumption penalty). There's a similar argument for ADC (open ADC when needed).

5.26 453-00068 On-Board PCB Trace Antenna Characteristics

The 453-00068 on-board PCB trace monopole antenna radiated performance depends on the host PCB layout.

The BL5340PA development board was used for BL5340PA development and the 453-00068 PCB antenna performance evaluation. To obtain similar performance, follow guidelines in section 8.2 Host PCB Land Pattern and Antenna Keep-out for the 453-00068 to allow the on-board PCB antenna to radiate and reduce proximity effects due to nearby host PCB GND copper or metal covers.

| Antenna Efficiency | 2402MHz | | 2440MHz | | 2480MHz | |
|-----------------------------|---------|----------|----------|----------|----------|----------|
| | Peak | Avg | Peak | Avg | Peak | Avg |
| 453-00068 PCB trace antenna | +0.2dBi | -4.24dBi | +1.49dBi | -3.19dBi | +1.39dBi | -3.27dBi |

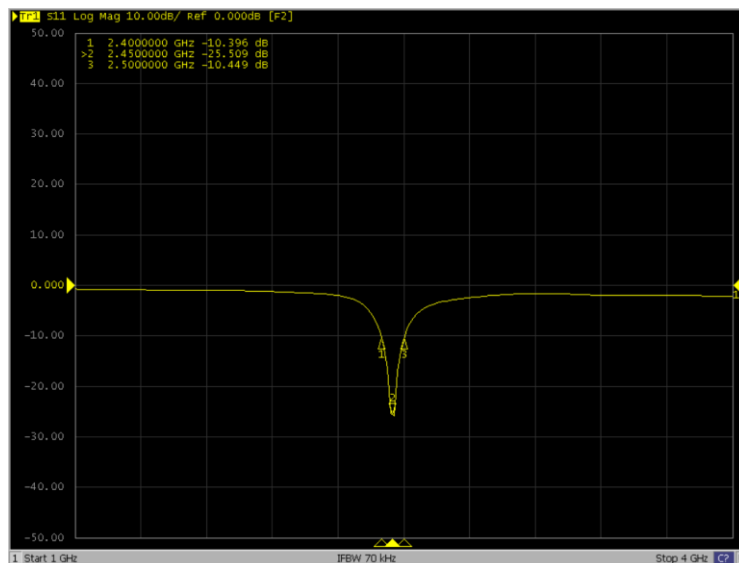
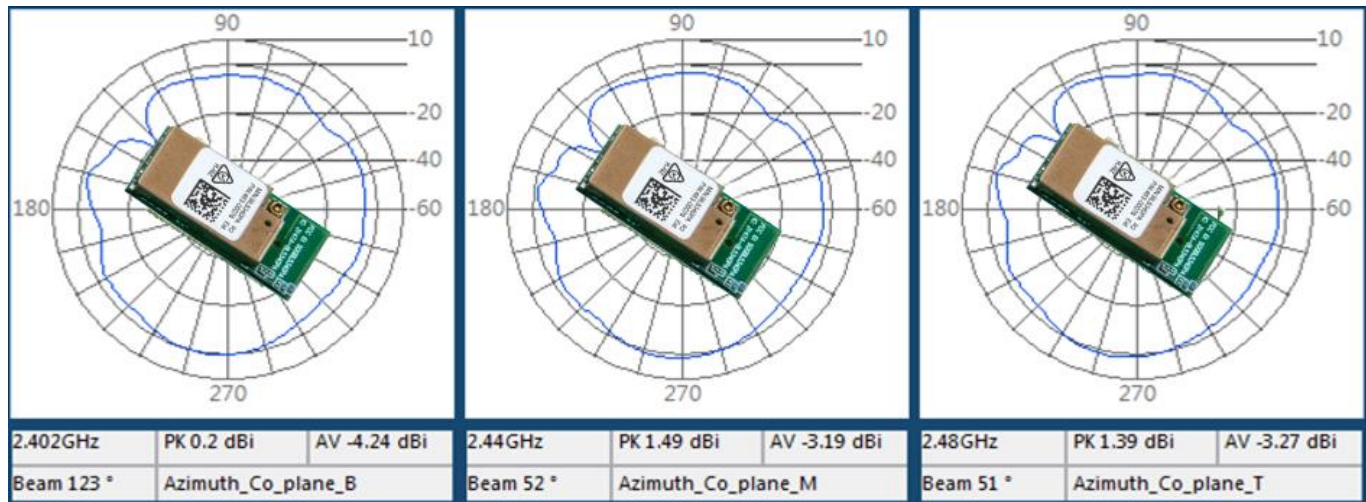


Figure 11: 453-00068 on-board PCB antenna performance (Antenna Gain and S11 – whilst 453-00068 module sitting on Devboard 453-00068-K1)

6 MANDATORY SW REQUIREMENTS RELATED TO HARDWARE

6.1 32MHz crystal internal load capacitor setting of 13.5pF (nRF5340)

MANDATORY. BL5340PA module contains the 32 MHz crystal but the load capacitors to create 32 MHz crystal oscillator circuit are inside the nRF5340 chipset. Customer **MUST** set the internal nRF5340 capacitors to 13.5 pF (for proper operation of the 32 MHz crystal circuit in the BL5340PA module).

6.2 MANDATORY SW REQUIREMENTS – FRONT END MODULE (FEM) nRF21540 CONTROL AND REGULATORY LIMITS FOR MAXIMUM RF TX POWER with FIXED default FEM TX_Gain=20dB

BL5340PA module does not ship with any FW. We recommend using Nordic Connect SDK (Zephyr) because it handles FEM timing and errata. We recommend using the Laird Connectivity FEM driver because it configures the RF TX power to the proper levels.

Customer is responsible for developing their end application SW and that operates BL5340PA within regulatory RF TX power limits defined in this section.

The below information covers the:

- Control of the nRF21540 FEM (BL5340PA developed using GPIO pin control, NOT SPI)
- BL53450PA certified for FIXED Nordic (chip to chip) programmed default nRF21540 FEM power amplifier TX_Gain=20dB±0.5dB (chip to chip)
 - nRF21540 FEM (POUTA_PROD=TX_Gain=20dB±0.5dB default at power-up)
- nRF5340 RF TX output level (into nRF21540 FEM Power amplifier) maximum allowed for each regulatory region for each PHY, each channel for each BL5340PA module HW variant.
- BL5340PA final RF TX output power that is certified for each regulatory region for each PHY, each channel for each BL5340PA module HW variant.

6.2.1 FEM (nRF21540) to nRF5340 Wiring Inside the BL5340PA and FEM control via GPIO

Figure 12 shows the nRF21540 FEM to nRF5340 connections inside the BL5340PA.

nRF21540 FEM radio control (of radio RF TX and RX)) by GPIO PIN control and the SPI Interface is only for setting FEM nRF21540 TX_Gain for power amplifier.

- **GPIO PIN control** (TX_EN, RX_EN, PDN, CSN), that is 4 pins. This gives the RF TX and RX functionality but no FEM TX_Gain control (**Note1**). PIN control actually needs 3 pins (TX_EN, RX_EN and PDN) but CSN pin is also needed for RX_EN control. GPIO pin control of the FEM nRF21540 will be part of the lower layers (BLE) so will not be user application dependent. When enabled and configured it will run automatically.
- **SPI control** (MISO, MOSI, SCK, CSN, PDN), that is 5pins. SPI **MUST** be used for setting FEM TX_Gain only and not for radio control in the BL5340PA. Cannot use SPI interface when radio being used.

Note1: **BL53450PA** currently certified for FIXED default nRF21540 FEM power amplifier POUTA_PROD=TX_Gain=20dB only, therefore cannot modify nRF21540 TX_Gain=20dB from this default value.

See nRF21540 datasheet:

https://infocenter.nordicsemi.com/index.jsp?topic=%2Fps_nrf21540%2Fkeyfeatures_html5.html&cp=7_0_0 for details.

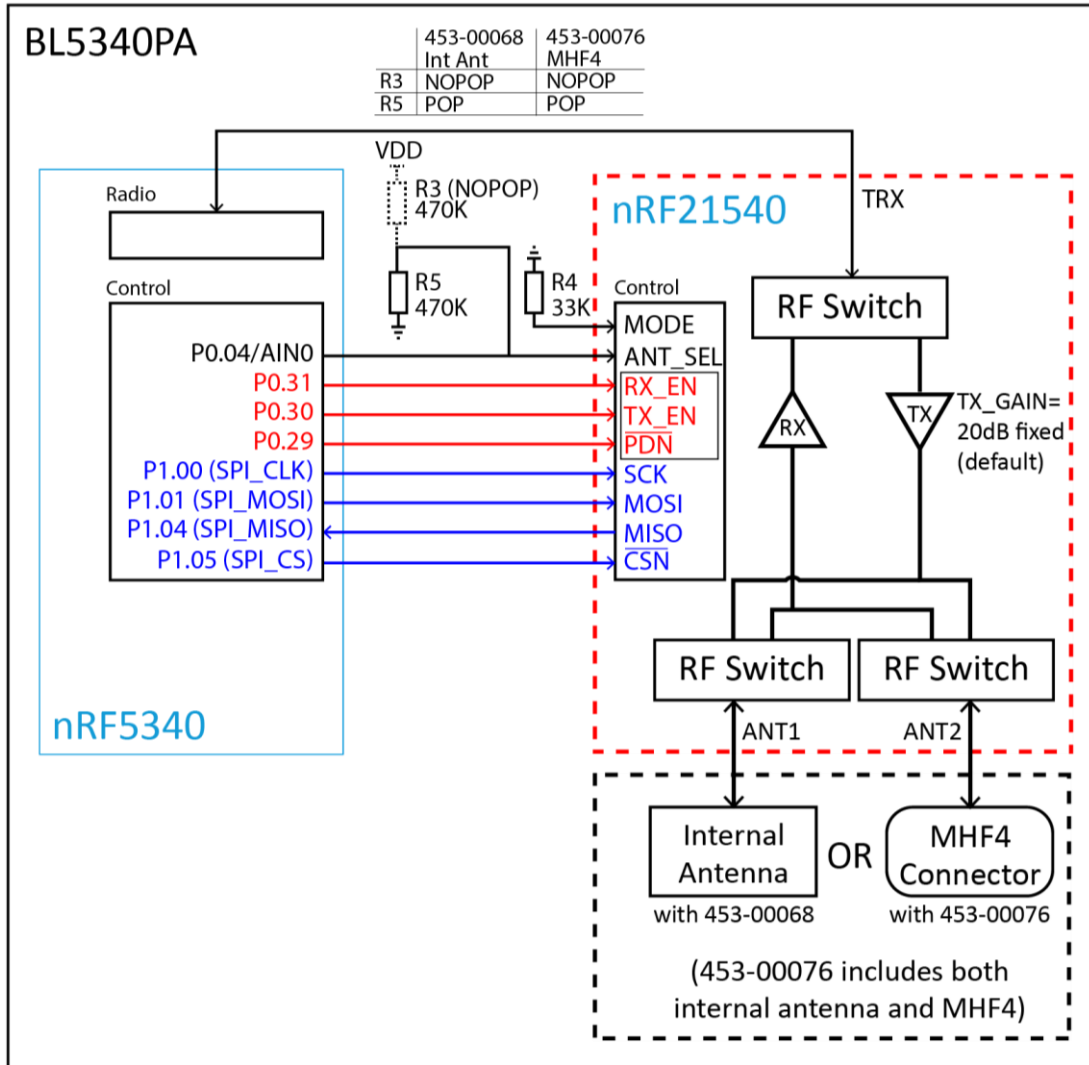


Figure 12: Block Diagram of Front End Module (FEM) nRF21540 Control

| nRF5340 GPIO/SPI | nRF5340 signal direction | nRF21540 FEM signal | nRF21540 FEM signal type | nRF21540 FEM signal description |
|------------------|--------------------------|---------------------|--------------------------|---------------------------------|
| | | MODE | Digital IN | TX power mode |
| P0.31 | Digital out | RX_EN | Digital IN | RX mode enable |
| P0.04/AIN0 | Digital out | ANT_SEL | Digital IN | Antenna select |
| P0.30 | Digital out | TX_EN | Digital IN | TX mode enable |
| P0.29 | Digital out | PDN | Digital IN | Power-down, active low |
| P1.00 (SPI_CLK) | Digital out | SCK | Digital IN | SPI clock |
| P1.01 (SPI_MOSI) | Digital out | MOSI | Digital IN | SPI data in |
| P1.04 (SPI_MISO) | Digital in | MISO | Digital OUT | SPI data out |
| P1.05 (SPI_CS) | Digital out | CSN | Digital IN | SPI chip select, active low |

Notes:-

Mode Pin

At power-up, the MODE pin is read and since the MODE pin connected to pull down resistor R4 (33k), the nRF21540 TX power mode is set to POUTA_SEL (and the TX_Gain=20dB±0.5dB value stored in nRF21540 chip production default value (POUTA_UICR is used) which is nRF21540 TX_gain=POUTA_PROD=20dB±0.5dB. Nordic sets this nRF21540 chip to chip to hit the TX_gain=POUTA_PROD=20dB±0.5dB.
Customer must NOT modify (via SPI) this default POUTA_UICR) which has Nordic default 20dB±0.5dB) or use POUTB_UICR (which has Nordic default 10dB).

nRF21540 TX_Gain=20dB (POUT_A UICR) must NOT be modified.

BL5340PA module HW variants are certified with FIXED default nRF21540 TX_gain=POUTA_PROD=20dB±0.5dB (which is TX_Gain value stored in nRF21540 chip production by Nordic, with the default value POUTA_UICR is used. Nordic sets this nRF21540 chip to chip to hit the TX_gain = POUTA_PROD = 20dB±0.5dB
Current BL5340PA certifications does NOT allow nRF21540 TX_Gain to be changed from this default. Customer MUST NOT modify or program the nRF21540 TX_Gain (POUTA_UICR), so to keep the FIXED default nRF21540 TX_gain=POUTA_PROD=20dB±0.5dB to stay within the regulatory limits defined in section 6.2.4.

PDN Pin

PDN pin is power down pin and is active high. Since PDN pin is controlled as part PIN CONTROL group (TX_EN, RX_EN, PDN, CSN), the nRF21540 is powered down (PDN=0) at every opportunity for low power solution and this means when device come out of power-down (PDN=1), all the registers will contain reset values, for example the TX_Gain will be default from PAOUTA_SEL.

ANT_SEL Pin

Customer (FW) MUST control nRF5340 P0.04 line per BL53450PA module HW variant to select the correct antenna port on nRF21540 by driving nRF21540 ANT_SEL pin from nRF5340 P0.04 line:-

| BL5340PA module HW variant | nRF5340 P0.04 line set by customer to control nRF21540 ANT_SEL pin | nRF21540 ANT port selected |
|---|--|----------------------------|
| 453-00068 BL5340PA module, integrated antenna | Low | ANT1 |
| 453-00076 BL5340PA module, MHF4 RF connector receptable for external antenna | High | ANT2 |

R5 pull-down resistor is fitted on both BL5340PA module HW variants (on the nRF5340 P0.04 line going to nRF21540 ANT_SEL line).

On the 453-00076 only, antenna switching (from ANT2 to ANT1) can be performed by driving nRF21540 ANT_SEL line from nRF5340 P0.04 line. This antenna switching is only usable on the 453-00076 only, as the other antenna port ANT1 on nRF21540 is connected to PCB Trace antenna on the 453-00076 BL5340PA module.

Antenna cannot be switched when radio is being used.

TX_EN, RX_EN, PDN

GPIO PIN control of nRF21540 FEM follow defaults from Nordic which is active high. CSN pin is needed for RX_EN.

Timing Control of nRF21540

Follow defaults from Nordic.

| GPIO PIN control for RF TX | GPIO PIN control for RF RTX |
|----------------------------|-----------------------------|
| | |

GPIO nRF5340 GPIO driving the nRF21540 states during low power modes

As defaults from Nordic.

When putting BL5340PA in low power mode (nRF5340 System ON Idle or SYSTEM OFF), all of the nRF5340 GPIO signals (P0.04/AIN0, P0.29, P0.30, P0.31, P1.00, P1.01, P1.04, P1.05) going to the nRF21540 FEM should be configured as output low except for P1.04/MISO which should be configured as input disconnect.

nRF21540 Nordic Errata document

Refer to the latest nRF21540 Errata document and apply the workaround mentioned https://infocenter.nordicsemi.com/topic/struct_fem/struct/nrf21540_errata.html?cp=7_0_1
https://infocenter.nordicsemi.com/pdf/nRF21540_Revision_2_Errata_v1.2.pdf

for example, errata:

3.4 [13] System: Increased supply current in Power down state with digital input pins at high level

6.2.2 Control nRF5340 P0.04 line per BL5340PA module Hardware variant

Customer MUST select per BL5340PA module HW variant (recorded on label), the correct state (output High or Low) of the nRF5340 P0.04 line that controls the nRF21540 ANT_SEL pin. Refer to table [ANT_SEL pin](#).

6.2.3 Antenna Selection support on 453-00076 BL5340PA module

Refer to table [ANT_SEL pin](#).

WARNING: See section 6.2.4 for actual radio regulatory RF TX power limit allowed for each regulatory region per radio PHY per channel per BL5340PA hardware variant. When switching antennas on the 453-00076 BL5340PA module HW variant for external antenna, remember external antenna gain maximum is 3.1dBi whilst when switching the antenna to Internal antenna which has lower gain of 1.49dBi, this means lower of the two RF TX power tables MUST be used. Since 453-00076 BL5340PA module, External Antenna HW variant for external antenna has lower RF TX Power settings, it is safe (in terms of radio regulatory certifications) on the 453-00076 BL5340PA module HW variant.

You MUST not use integrated antenna values for the external antenna HW variant.

6.2.4 BL5340PA Certified TX Power Per Regulatory Region and Hardware Variant

The following sections shows per BL5340PA module HW variant and per radio regulatory region, the maximum allowed nRF5340 TX power setting (with VREQCTRL OFF) per PHY, per channel with FIXED default FEM (nR21540) TX_gain=POUTA_PROD=20dB±0.5dB settings used to achieve the maximum BL5340PA module (per HW variant) RF TX power for each regulatory region.

6.2.4.1 Maximum RF TX power per Hardware Variant, PHY, Channel, with FIXED FEM (nRF21540) and Default TX_Gain (FCC and ISED)

Table 42 and Table 43 below shows per BL5340PA module HW variant, the maximum certified nRF5340 RF TX power per PHY, per channel with FIXED FEM nRF21540 default TX_Gain=PAOUT_PROD=20dB allowed for radio regulatory region of FCC (USA), ISED (Canada).

Note: Red colour shows the differences in settings between the two hardware variants.

Table 42: Max TX Power Settings for 453-00068 BL5340PA module, Integrated Antenna, FCC and ISED Region

| nRF5340 TX max power settings per PHY per Channel for 453-00068 BL5340PA module, Integrated Antenna for FCC, ISED regulatory region | | | | |
|---|---------|---------------|---|---|
| Internal antenna maximum peak antenna gain =1.49dBi | | | | |
| BL5340PA certification are with:- | | | | |
| <ul style="list-style-type: none"> nRF21540 FIXED Nordic default TX_GAIN=PAOUT_PROD=20dB. nRF5340 VREQCTRL turned OFF | | | | |
| PHY | Channel | Frequency MHz | nRF5340 RF TX power (dBm) setting allowed with VREQCTRL OFF | Measured BL5340PA conducted RF TX power (dBm) |
| BLE 1Mbps | CH0 | 2402 | -4dBm | 18.11dBm |
| | CH19 | 2440 | -4dBm | 18.02dBm |
| | CH39 | 2480 | -5dBm | 16.45dBm |
| BLE 2Mbps | CH1 | 2404 | -4dBm | 18.09dBm |
| | CH19 | 2440 | -4dBm | 17.97dBm |
| | CH38 | 2478 | -8dBm | 13.01dBm |
| BLE coded PHY 125kbps | CH0 | 2402 | -8dBm | 12.78dBm |
| | CH19 | 2440 | -8dBm | 13.46dBm |
| | CH39 | 2480 | -8dBm | 13.39dBm |
| BLE coded PHY 500kbps | CH0 | 2402 | -4dBm | 18.14dBm |
| | CH19 | 2440 | -4dBm | 18.03dBm |
| | CH39 | 2480 | -5dBm | 16.38dBm |

Table 43: Max TX Power Settings for 453-00076 BL5340PA module, External Antenna, FCC and ISED Region

| nRF5340 TX max power settings per PHY per Channel for 453-00076 BL5340PA module, External Antenna, MHF4 RF connector for FCC, ISED regulatory region | | | | |
|--|---------|---------------|---|---|
| External antenna maximum peak antenna gain =3.1dBi | | | | |
| BL5340PA certification are with:- | | | | |
| <ul style="list-style-type: none"> nRF21540 FIXED Nordic default TX_GAIN=PAOUT_PROD=20dB. nRF5340 VREQCTRL turned OFF. | | | | |
| PHY | Channel | Frequency MHz | nRF5340 RF TX power (dBm) setting allowed with VREQCTRL OFF | Measured BL5340PA conducted RF TX power (dBm) |
| BLE 1Mbps | CH0 | 2402 | -5dBm | 16.31dBm |
| | CH19 | 2440 | -6dBm | 16.16dBm |
| | CH39 | 2480 | -7dBm | 14.76dBm |
| BLE 2Mbps | CH1 | 2404 | -5dBm | 16.29dBm |
| | CH19 | 2440 | -6dBm | 16.15dBm |
| | CH38 | 2478 | -12dBm | 9.11dBm |
| BLE coded PHY 125kbps | CH0 | 2402 | -8dBm | 12.78dBm |
| | CH19 | 2440 | -8dBm | 13.46dBm |
| | CH39 | 2480 | -8dBm | 13.39dBm |
| BLE coded PHY 500kbps | CH0 | 2402 | -5dBm | 16.41dBm |
| | CH19 | 2440 | -6dBm | 16.17dBm |
| | CH39 | 2480 | -7dBm | 14.75dBm |

Note: Different TX power settings are used on 453-00076 BL5340PA module, External Antenna, MHF4 RF connector because the highest external antenna gain is higher at 3.1dB.

| | | | | |
|-----------------------------|------|------|-------|----------|
| IEEE 802.15.4: 2006 250kbps | CH11 | 2405 | 0dBm | 21.10dBm |
| | CH18 | 2440 | 0dBm | 20.98dBm |
| | CH25 | 2475 | -7dBm | 15.02dBm |
| | CH26 | 2480 | TBD | TBD |

| | | | | |
|-----------------------------|------|------|-------|----------|
| IEEE 802.15.4: 2006 250kbps | CH11 | 2405 | 0dBm | 21.10dBm |
| | CH18 | 2440 | 0dBm | 20.98dBm |
| | CH25 | 2475 | -8dBm | 13.44dBm |
| | CH26 | 2480 | TBD | TBD |

Notes:-

3. Customer MUST use the nRF5340 maximum RF TX power setting (with nRF5340 VREQCTRL turned OFF) only to stay with radio regulatory certifications.
4. Customer must NOT change the maximum regulatory certified Nordic default nRF21540 TX_Gain=PAOUTA_PROD of 20dB±0.5dB into POUT_A UICR, which Nordic program into nRF21540 chip by chip.
The reason is that a different nRF5340 RF TX power setting is used on 453-00076 BL5340PA module, MHF4 RF connector module HW variant is that highest External antenna gain is higher at 3.1dB compared to the 453-00068 BL5340PA module, integrated antenna module HW variant integrated antenna gain of 1.49dBi.
Hence MUST not use RF TX power table for 453-00068 BL5340PA module, Integrated Antenna on a 453-00076 BL5340PA module, External Antenna HW variant.
5. BLE 1Mbps PHY Ch39 2480MHz RF TX power must be limited to lower value to pass FCC/ISED Band Edge emission limit.
6. BLE 2Mbps PHY Ch38 2478MHz RF TX power must be limited to lower value to pass FCC/ISED Band Edge emission limit.
7. BLE 125kpps coded PHY RF TX power must be limited to lower value to pass FCC/ISED Power Spectral Density limit.
8. BLE 500kpps coded PHY Ch39 2480MHz RF TX power must be limited to lower value to pass FCC/ISED Band Edge emission limit.
9. IEEE 802.15.4:2006 PHY CH25(2475MHz), RF TX power must be limited to lower value to pass FCC/ISED Band Edge emissions limit.
10. The CH26 (2480MHz) IEEE 802.15.4:2006 RF TX power must be limited to lower value to pass FCC/ISED Band Edge emission limit.
11. the BLE 2Mbps is NOT used on BLE legacy advertising channels as per BTCore5.x document. BLE legacy advertising only done on BLE 1Mbps, coded PHY 125kbps and coded PHY 500kbps. When BLE 2Mbps is used in a BLE data connection, the RF TX power on CH38 being lower than the other 36 channels should not impair system performance as there are still 36 other channels at full RF TX power and BLE uses frequency hopping.
12. BL5340PA is radio regulatory certified with nRF5340 VREQCTRL turned OFF. BL5340PA customer must keep the nRF5340 VREQCTRL turned OFF to stay within BL5340PA radio regulatory certifications. See [VREQCTRL - Voltage request control \(VREQCTRL OFF for BL5340PA\)](#).

6.2.4.2 Maximum RF TX power per Hardware Variant, PHY, Channel, with FIXED FEM (nRF21540) and Default TX_Gain (RCM – Australia and New Zealand)

Table 44 and Table 45 below shows per BL5340PA module HW variant, the maximum certified nRF5340 RF TX power per PHY, per channel with FIXED FEM (nRF21540) default TX_Gain=PAOUTA_PROD=20dB allowed for radio regulatory region of RCM (Australia, New Zealand).

Note: Red colour shows the differences in setting between BL5340PA module HW variant.

Table 44: Max TX Power Settings for 453-00068 BL5340PA module, Integrated Antenna, RCM Region

| nRF5340 TX max power settings per PHY per Channel for 453-00068 BL5340PA module, Integrated Antenna for RCM (Australia, New Zealand) region | | | | |
|---|---------|---------------|---|--------------------------------------|
| Internal antenna maximum peak antenna gain =1.49dBi | | | | |
| BL5340PA certification are with: | | | | |
| <ul style="list-style-type: none"> nRF21540 FIXED Nordic default TX_GAIN=PAOUT_PROD=20dB. nRF5340 VREQCTRL turned OFF | | | | |
| PHY | Channel | Frequency MHz | nRF5340 RF TX power (dBm) setting allowed with VREQCTRL OFF | BL5340PA conducted RF TX power (dBm) |
| BLE 1Mbps | CH0 | 2402 | -4dBm | 18.05dBm |
| | CH19 | 2440 | -4dBm | 17.98dBm |
| | CH39 | 2480 | -4dBm | 17.76dBm |
| BLE 2Mbps | CH1 | 2404 | -4dBm | 18.05dBm |
| | CH19 | 2440 | -4dBm | 17.98dBm |
| | CH38 | 2478 | -4dBm | 17.76dBm |
| BLE coded PHY 125kbps | CH0 | 2402 | -4dBm | 18.47dBm |
| | CH19 | 2440 | -5dBm | 17.76dBm |
| | CH39 | 2480 | -4dBm | 18.32dBm |
| BLE coded PHY 500kbps | CH0 | 2402 | -4dBm | 18.45dBm |
| | CH19 | 2440 | -5dBm | 17.27dBm |
| | CH39 | 2480 | -4dBm | 18.27dBm |

Table 45: Max TX Power Settings for 453-00076 BL5340PA module, External Antenna, MHF4 RF connector, RCM Region

| nRF5340 TX max power settings per PHY per Channel for 453-00076 BL5340PA module, External Antenna, MHF4 RF connector for RCM (Australia, New Zealand) region | | | | |
|--|---------|---------------|---|--------------------------------------|
| External antenna maximum peak antenna gain =3.1dBi | | | | |
| BL5340PA certification are with: | | | | |
| <ul style="list-style-type: none"> nRF21540 FIXED Nordic default TX_GAIN=PAOUT_PROD=20dB. nRF5340 VREQCTRL turned OFF | | | | |
| PHY | Channel | Frequency MHz | nRF5340 RF TX power (dBm) setting allowed with VREQCTRL OFF | BL5340PA conducted RF TX power (dBm) |
| BLE 1Mbps | CH0 | 2402 | -5dBm | 16.41dBm |
| | CH19 | 2440 | -6dBm | 16.27dBm |
| | CH39 | 2480 | -6dBm | 16.56dBm |
| BLE 2Mbps | CH1 | 2404 | -5dBm | 16.36dBm |
| | CH19 | 2440 | -6dBm | 16.19dBm |
| | CH38 | 2478 | -6dBm | 16.54dBm |
| BLE coded PHY 125kbps | CH0 | 2402 | -6dBm | 16.44dBm |
| | CH19 | 2440 | -7dBm | 15.33dBm |
| | CH39 | 2480 | -7dBm | 15.03dBm |
| BLE coded PHY 500kbps | CH0 | 2402 | -6dBm | 16.41dBm |
| | CH19 | 2440 | -7dBm | 15.33dBm |
| | CH39 | 2480 | -6dBm | 16.72dBm |

Note: Different TX power settings are used on 453-00076 BL5340PA module, External Antenna, MHF4 RF connector because the highest external antenna gain is higher at 3.1dB.

| | | | | |
|-----------------------------|------|------|-------|----------|
| IEEE 802.15.4: 2006 250kbps | CH11 | 2405 | -1dBm | 20.92dBm |
| | CH18 | 2440 | -1dBm | 20.79dBm |
| | CH25 | 2475 | -1dBm | 20.02dBm |
| | CH26 | 2480 | TBD | TBD |

| | | | | |
|-----------------------------|------|------|-------|----------|
| IEEE 802.15.4: 2006 250kbps | CH11 | 2402 | -1dBm | 20.92dBm |
| | CH18 | 2440 | -1dBm | 20.79dBm |
| | CH25 | 2475 | -1dBm | 20.02dBm |
| | CH26 | 2480 | TBD | TBD |

Notes:-

13. Customer MUST use the nRF5340 maximum RF TX power setting (with nRF5340 VREQCTRL turned OFF) only to stay with radio regulatory certifications.
14. Customer must NOT change the maximum regulatory certified Nordic default nRF21540 TX_Gain=PAOUT_PROD=20dB±0.5dB into POUT_A UICR, which Nordic program into nRF21540 chip by chip. The reason is that different nRF5340 RF TX power settings are used on the 453-00076 BL5340PA module, MHF4 RF connector module HW variant is that the highest External antenna gain is higher at 3.1dB compared to the 453-00068 BL5340PA module, Integrated Antenna module HW variant integrated antenna gain of 1.49dBi. Hence MUST not use RF TX power table for 453-00068 BL5340PA module, Integrated Antenna on a 453-00076 BL5340PA module, External Antenna HW variant.
15. BLE 1Mbps PHY RF TX power limited by RCM Power Spectral Density limit.
16. BLE 2Mbps PHY RF TX power limited by RCM Power Spectral Density limit.
17. BLE 125kkps coded PHY RF TX power limited by RCM Power Spectral Density limit.
18. BLE 500kkps coded PHY RF TX power limited by RCM Power Spectral Density limit
19. IEEE 802.15.4:2006 PHY CH25(2475MHz), RF TX power limited by RF TX power limited by RCM Power Spectral Density limit.
20. The CH26 (2480MHz) IEEE 802.15.4:2006 RF TX power must be limited to lower value to pass RCM Band Edge emission limit.
21. the BLE 2Mbps is NOT used on BLE legacy advertising channels as per BTCore5.x document. BLE legacy advertising only done on BLE 1Mbps, coded PHY 125kbps and coded PHY 500kbps. When BLE 2Mbps is used in a BLE data connection, the RF TX power on CH38 being lower than the other 36 channels should not impair system performance as there are still 36 other channels at full RF TX power and BLE uses frequency hopping.
22. BL5340PA is radio regulatory certified with nRF5340 VREQCTRL turned OFF. BL5340PA customer must keep the nRF5340 VREQCTRL turned OFF to stay within BL5340PA radio regulatory certifications. See [VREQCTRL - Voltage request control \(VREQCTRL OFF for BL5340PA\)](#).

6.2.5 nRF5340 network core activity and ±64MHz RF TX signal spur

NOTE: Any FW (developed by customer for normal BLE or 802.15.4:2006 operation) that uses the nRF5340 network core and if that FW creates constant activity in the network core, then may produce RF TX spurs at ±64MHz offset from the RF TX signal. Customer should measure RF TX signal ±64MHz offset spurs and ensure level is within the FCC, ISSED, RCM radio regulatory limits.

What does “constant activity in the network core” cover?

Constant network core activity may arise for example if FW used a wait between polling the UART interface meaning using a “do nothing” loop to pause the thread while waiting for next UART poll. This prevents the network core from entering idle state during waiting, resulting in “network core constant activity”. The RF TX signal spurs ±64MHz rise since radio is active while the main thread executing. Change the waiting to use a timer to schedule the UART polling.

Can peripherals in network core be used at same time as radio?

Using the network core for other peripherals in addition to radio should be acceptable.

During normal use, the radio thread (in FW) will take priority over other threads running on the network core. This means that there will not other activity on the network core while radio is transmitting.

Using the Nordic nRF Connect SDK should mitigate this issue.

7 HARDWARE INTEGRATION SUGGESTIONS

7.1 Circuit

The BL5340PA is easy to integrate, requiring no external components on your board apart from those which you require for development and in your end application.

The following are suggestions for your design for the best performance and functionality.

Checklist (for Schematic):

- **BL5340PA power**

Normal voltage mode: MUST connect the external supply voltage to BOTH the VDD and VDDH pins (so that VDD equals VDD_HV). Connect external supply within range 3.0V to 3.6V range to BL5340PA VDD and VDD_HV pins.

External power source should be within the operating range, rise time and noise/ripple specification of the BL5340PA. Add decoupling capacitors for filtering the external source. Power-on reset circuitry within BL5340PA series module incorporates brown-out detector, thus simplifying your power supply design. Upon application of power, the internal power-on reset ensures that the module starts correctly.

- **BL5340PA USB peripheral:**

To use the BL5340PA USB peripheral:

23. Connect the BL5340PA VBUS pin to the external supply within the range 4.35V to 5.5V. When using the BL5340PA VBUS pin, you **MUST** externally fit a 4.7uF to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized.

24. Connect the external supply (3.0V to 3.6V) to BOTH the VDD and VDD_HV pins to operate the rest of BL5340PA module.

An optional series 4.7Ohms resistor on the USB supply (VBUS) can be fitted for improved immunity to transient over-voltage VBUS connection.

If not using USB peripheral, the VBUS pin can be left unconnected.

- **AIN (ADC) and GPIO pin IO voltage levels**

BL5340PA GPIO voltage levels are at VDD. Ensure input voltage levels into GPIO pins are at VDD also (if VDD source is a battery whose voltage drops). Ensure ADC pin maximum input voltage for damage is not violated.

- **AIN (ADC) impedance and external voltage divider setup**

If you need to measure with ADC a voltage higher than 3.6V, you can connect a high impedance voltage divider to lower the voltage to the ADC input pin.

- **SWD**

This is REQUIRED for loading firmware. MUST wire out the SWD two wire interface on host design (see [Figure 10](#)). Five lines should be wired out, namely SWDIO, SWDCLK, nRESET, GND and VDD.

- **UART and flow control (CTS, RTS)**

Required if customer requires UART.

- **TWI (I2C)**

It is essential to remember that pull-up resistors on both SCL and SDA lines are required, the value as per I2C standard. nRF5340 can provide 13K Ohms typical pull up values internally. For other values, fit external pull-up resistor on both SCL and SDA as per I2C specification to set speed. The I2C specification allows a line capacitance of 400pF.

- **QSPI, High Speed SPI (SPIM4, 32Mbps), High speed TWI (I2C, 1Mbps), QSPI and Trace**

QSPI, High-Speed SPI (SPIM4) 32Mbps, TWI 1Mbps and Trace come on dedicated GPIO pins only. Other lower speed SPI and TWI can come out on any GPIO pins.

For all high-speed signal, the printed circuit board (PCB) layout must ensure that connections are made using short PCB traces.

- **GPIO pins**

If GPIO is selected as an input, ensure the input is not floating (which can cause current consumption to drive with time in low power modes (such as System ON Idle), by selecting the internal pull up or pull down.

- **NFC antenna connector**

To make use of the Laird Connectivity flexi-PCB NFC antenna (datasheet [here](#)), fit connector:

- Description: FFC/FPC Connector, Right Angle, SMD/90d, Dual Contact, 1.2 mm Mated Height
- Manufacturer: Molex
- Manufacturers Part number: 512810594

Add tuning capacitors of 300 pF on NFC1 pin to GND and 300 pF on NFC2 pins to GND if the PCB track length is similar as development board.

- **nRESET pin (active low)**

Hardware reset. Wire out to push button or drive by host.

By default module is out of reset when power applied to VDD pins (13K pull-up inside nRF5340PA).

- **Optional External 32.768kHz crystal**

If the optional external 32.768kHz crystal is needed, then use a crystal that meets specification and add load capacitors (either inside nRF5340 or discrete capacitors outside nRF53) whose values should be tuned to meet all specification for frequency and oscillation margin.

- **453-00076 BL5340PA module, External Antenna, MHF4 RF Connector HW variant supports Dual Antenna**

See section [6.2.3 Antenna Selection support on 453-00076 BL5340PA module](#).

7.2 PCB Layout on Host PCB - General

Checklist (for PCB):

- MUST locate BL5340PA module close to the edge of PCB (mandatory for the 453-00068 for on-board PCB trace antenna to radiate properly).
- Use solid GND plane on inner layer (for best EMC and RF performance).
- All module GND pins MUST be connected to host PCB GND.
- Place GND vias close to module GND pads as possible.
- Unused PCB area on surface layer can be flooded with copper but place GND vias regularly to connect the copper flood to the inner GND plane. If GND flood copper is on the bottom of the module, then connect it with GND vias to the inner GND plane.
- Route traces to avoid noise being picked up on VDD, VDDH, VBUS supply and AIN (analogue), GPIO (digital) traces and high-speed traces.
- Ensure no exposed copper is on the underside of the module (refer to land pattern of BL5340PA development board).

7.3 PCB Layout on Host PCB for the 453-00068

7.3.1 Antenna Keep-out on Host PCB

The 453-00068 has an integrated PCB trace antenna and its performance is sensitive to host PCB. It is critical to locate the 453-00068 on the edge of the host PCB (or corner) to allow the antenna to radiate properly. Refer to guidelines in section [8.2 Host PCB Land Pattern and Antenna Keep-out for the 453-00068](#). Some of those guidelines repeated below.

- Ensure there is no copper in the antenna keep-out area on any layers of the host PCB. Keep all mounting hardware and metal clear of the area to allow proper antenna radiation.
- For best antenna performance, place the 453-00068 module on the edge of the host PCB, preferably in the edge center.
- The BL5340PA development board (453-00068-K1) has the 453-00068 module on the edge of the board (not in the corner). The antenna keep-out area is defined by the BL5340PA development board which was used for module development and antenna performance evaluation is shown in [Figure 13](#), where the antenna keep-out area is ~4.7 mm wide, ~39.17 mm long; with PCB dielectric (no copper) height ~1 mm sitting under the 453-00068 PCB trace antenna.
- The 453-00068 PCB trace antenna is tuned when the 453-00068 is sitting on development board (host PCB) with size of 135 mm x 110 mm x 1mm.
- A different host PCB thickness dielectric will have small effect on antenna.
- The antenna-keep-out defined in [8.2 Host PCB Land Pattern and Antenna Keep-out for the 453-00068](#).
- Host PCB land pattern and antenna keep-out for the BL5340PA applies when the 453-00068 is placed in the edge of the host PCB preferably in the edge center. [Figure 13](#) shows an example.

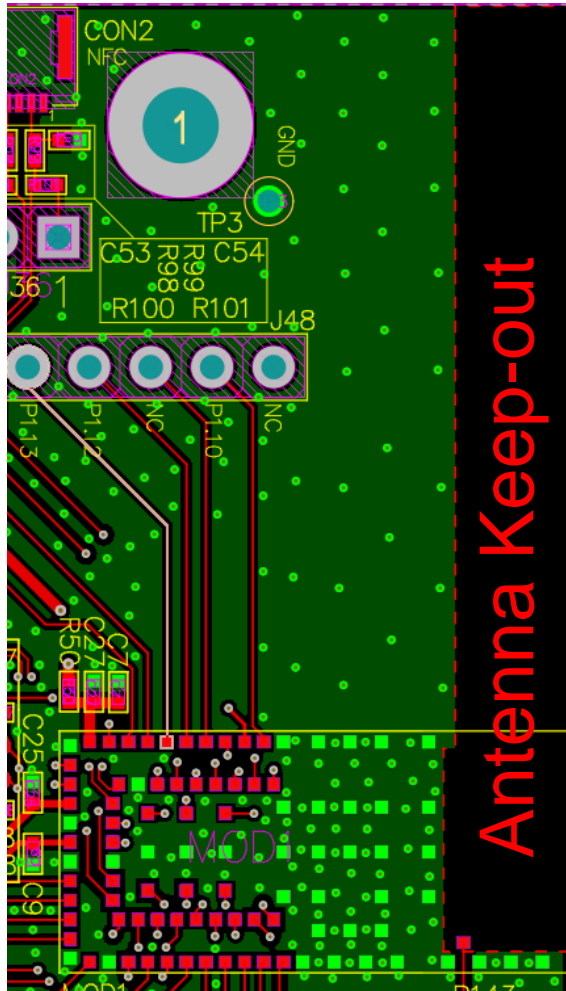


Figure 13: PCB trace Antenna keep-out area on the edge (and off center) of the BL5340PA development board for the 453-00068 module.

Antenna Keep-out Notes:

- | | |
|---------------|--|
| Note 1 | The BL5340PA module is placed on the edge, preferably edge centre of the host PCB. |
| Note 2 | Copper cut-away on all layers in the <i>Antenna Keep-out</i> area under the 453-00068 on host PCB. |

7.3.2 Antenna Keep-out and Proximity to Metal or Plastic

Checklist (for metal /plastic enclosure):

- Minimum safe distance for metals without seriously compromising the antenna (tuning) is 40 mm top/bottom and 30 mm left or right.
- Metal close to the 453-00068 PCB trace monopole antenna (bottom, top, left, right, any direction) will have degradation on the antenna performance. The amount of that degradation is entirely system dependent, meaning you will need to perform some testing with your host application.
- Any metal closer than 20 mm will begin to significantly degrade performance (S11, gain, radiation efficiency).
- It is best that you test the range with a mock-up (or actual prototype) of the product to assess effects of enclosure height (and materials, whether metal or plastic) and host PCB ground (GND) plane size.

7.4 External Antenna Integration with the 453-00076

Please refer to the regulatory sections for FCC, ISED and RCM details of use of BL5340PA with external antennas in each regulatory region.

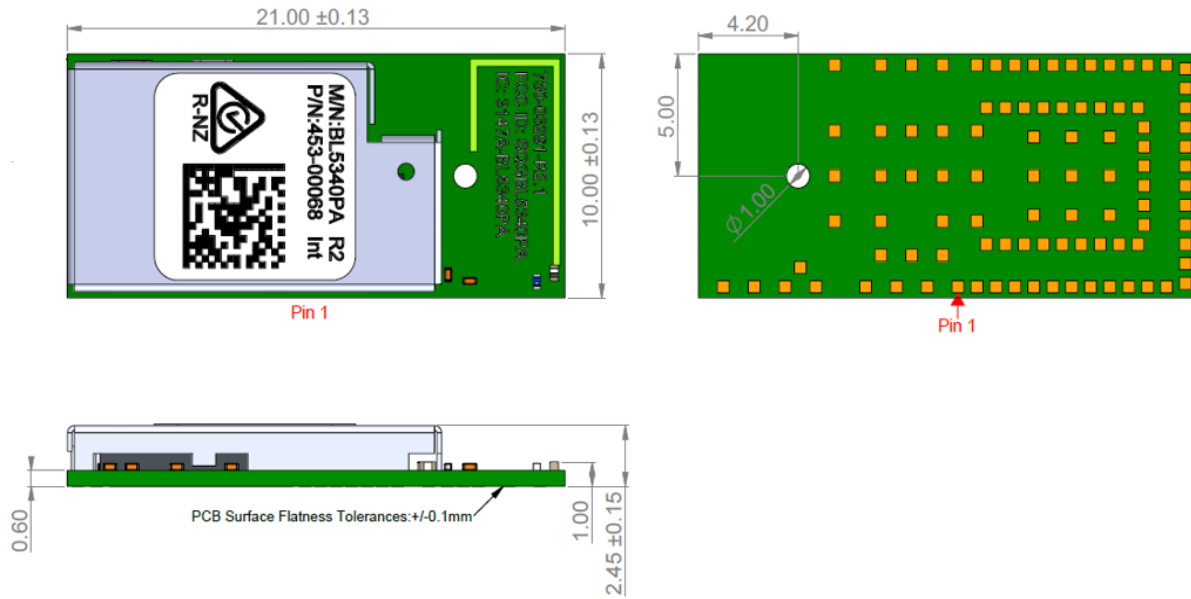
The BL5340PA family has been designed to operate with the below external antennas (with a maximum gain of 3.1 dBi). The required antenna impedance is 50 ohms. See [Table 46](#). External antennas improve radiation efficiency.

Table 46: External antennas for the BL5340PA

| Manufacturer | Model | Laird Connectivity Part Number | Type | Connector | Peak Gain | |
|--------------------|-----------------------------------|--------------------------------|------------|------------|---------------|---------------|
| | | | | | 2400-2500 MHz | 2400-2480 MHz |
| Laird Connectivity | NanoBlue | EBL2400A1-10MH4L | PCB Dipole | IPEX MHF4 | 2 dBi | - |
| Laird Connectivity | FlexPIFA | 001-0022 | PIFA | IPEX MHF4 | - | 2 dBi |
| Mag.Layers | EDA-8709-2G4C1-B27-CY | 0600-00057 | Dipole | IPEX MHF4 | 2 dBi | - |
| Laird Connectivity | mFlexPIFA | EFA2400A3S-10MH4L | PIFA | IPEX MHF4L | - | 2 dBi |
| Laird Connectivity | iFlexPIFA | EFG2400A3S-10MHF4L | PIFA | IPEX MHF4L | - | 3.1 dBi |
| Laird Connectivity | Laird Connectivity NFC (13.56MHz) | 0600-00061 | NFC coil | N/A | - | - |

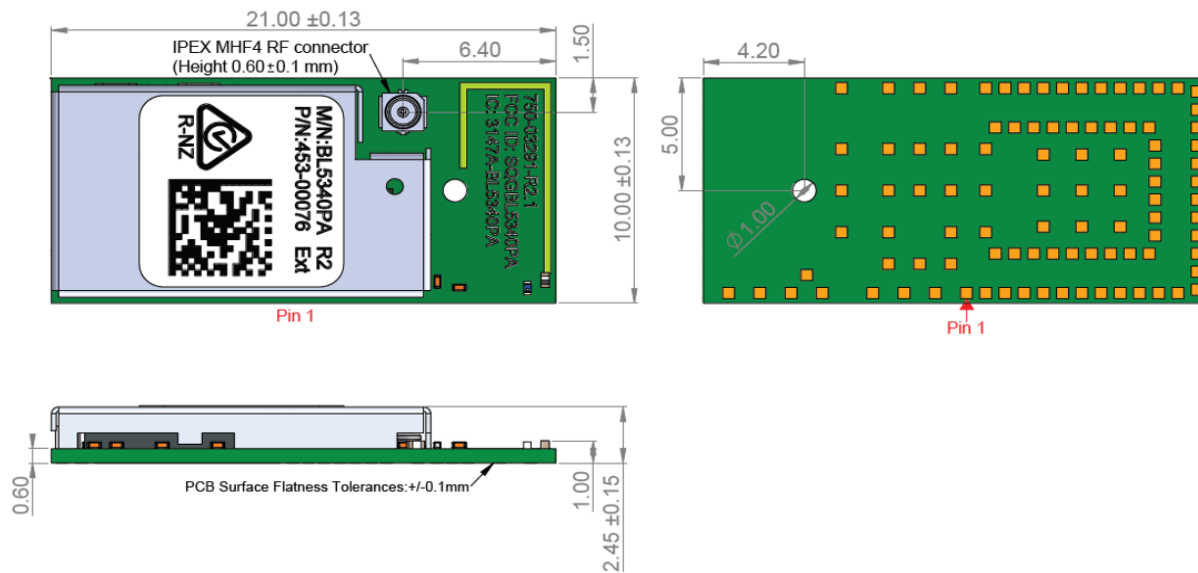
8 MECHANICAL DETAILS

8.1 BL5340PA Mechanical Details



All dimensions are in mm.

453-00068 BL5340PA module, integrated antenna



All dimensions are in mm.

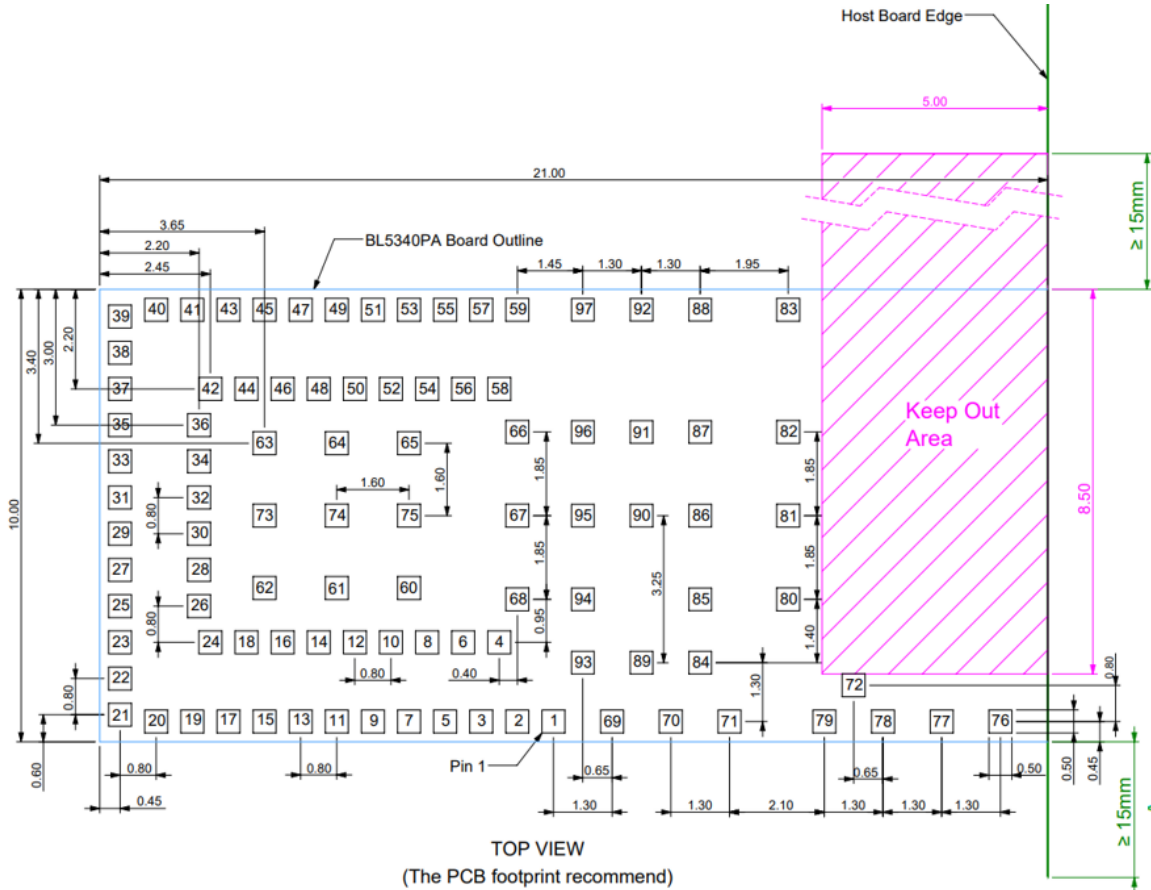
453-00076 BL5340PA module, MHF4 RF connector receptacle for external antenna

Figure 14: BL5340PA mechanical drawings

3D models for External Antenna and Internal Antenna, SCH symbols (Altium format), PCB footprints (DXF and Altium format) and Development Kit Schematics can be found on the BL5340PA product page – <http://lairdconnect.com/bl5340pa-series>

8.2 Host PCB Land Pattern and Antenna Keep-out for the 453-00068

SCH symbols (Altium format) and PCB footprints (DXF and Altium format) can be found on the BL5340PA product page – <http://lairdconnect.com/bl5340pa-series>



All dimensions are in mm.

Figure 15: Host PCB land pattern (top view) and Antenna Keep-out for the 453-00068

Host PCB Land Pattern and Antenna Keep-out for the 453-00068 Notes:

| | |
|---------------|---|
| Note 1 | Ensure there is no copper in the antenna 'keep out area' on any layers of the host PCB. Also keep all mounting hardware or any metal clear of the area (Refer to 7.3.2) to reduce effects of proximity detuning the antenna and to help antenna radiate properly. |
| Note 2 | For the best on-board antenna performance, the module 453-00068 MUST be placed on the edge of the host PCB and preferably in the edge centre and host PCB, the antenna "Keep Out Area" is extended (see Note 4), keep at least 15mm extension in antenna keep-out area (see figure 19). Keep at least 15mm of host PCB GND copper along the side marked A (the side with pins 77, 76, 78, 70). |
| Note 3 | BL5340PA development board has the 453-00068 module placed on the edge of the PCB board (and not in corner) for that the Antenna keep out area is extended up to the corner of the development board, see DVK-BL5340PA devboard example in section 7.3.1. |
| Note 4 | Ensure that there is no exposed copper under the module on the host PCB. |
| Note 5 | You may modify the PCB land pattern dimensions based on their experience and/or process capability. |

9 APPLICATION NOTE FOR SURFACE MOUNT MODULES

9.1 Introduction

Laird Connectivity surface mount modules are designed to conform to all major manufacturing guidelines. This application note is intended to provide additional guidance beyond the information that is presented in the User Manual. This Application Note is considered a living document and will be updated as new information is presented.

The modules are designed to meet the needs of several commercial and industrial applications. They are easy to manufacture and conform to current automated manufacturing processes.

9.2 Shipping

9.2.1 Tape and Reel Package Information

Notes:

- All dimensions are in millimeters.
- Material is High Impact Polystyrene (HIPS)
- Surface resistivity $10^7 \sim 10^{11} \Omega/\square$

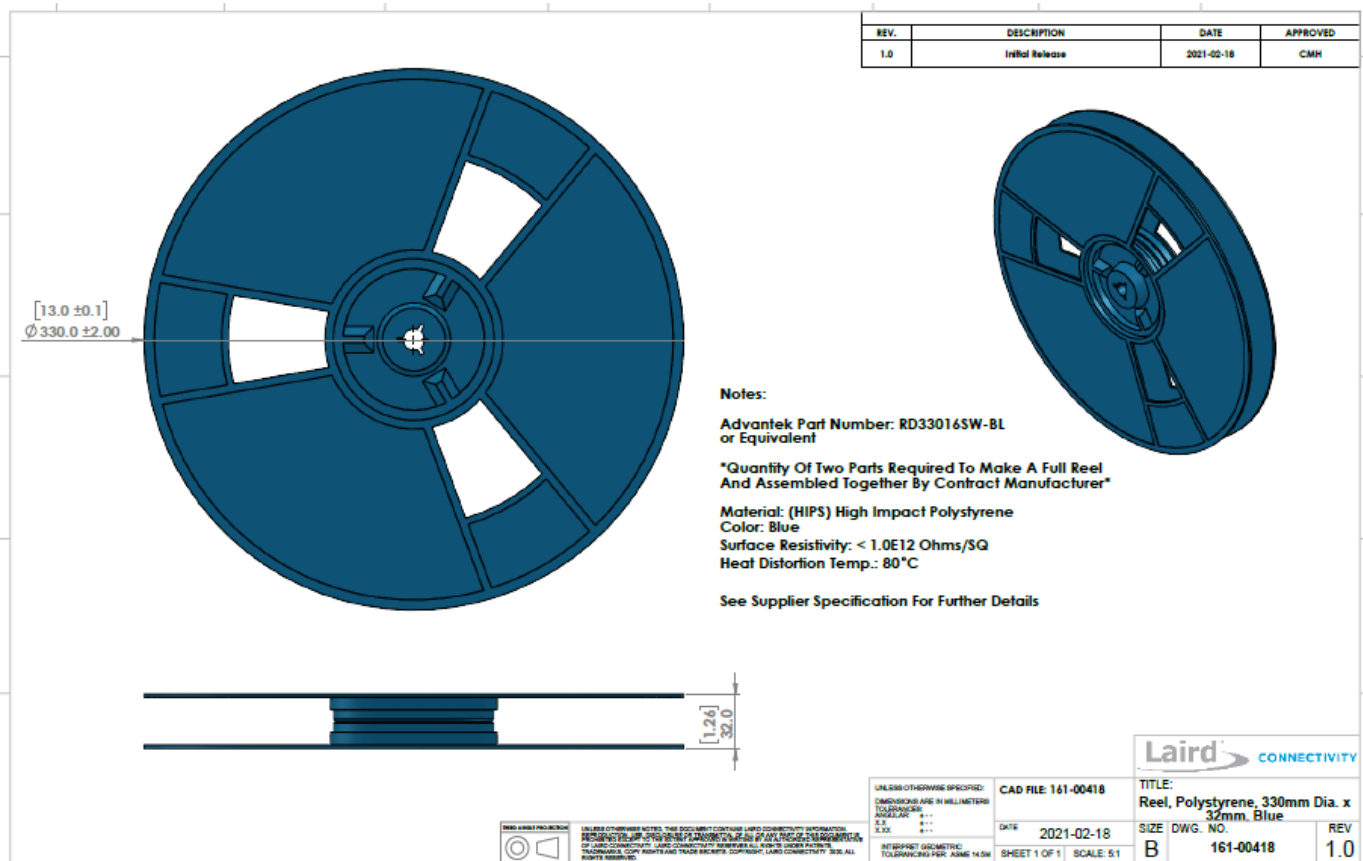


Figure 16: Reel specifications

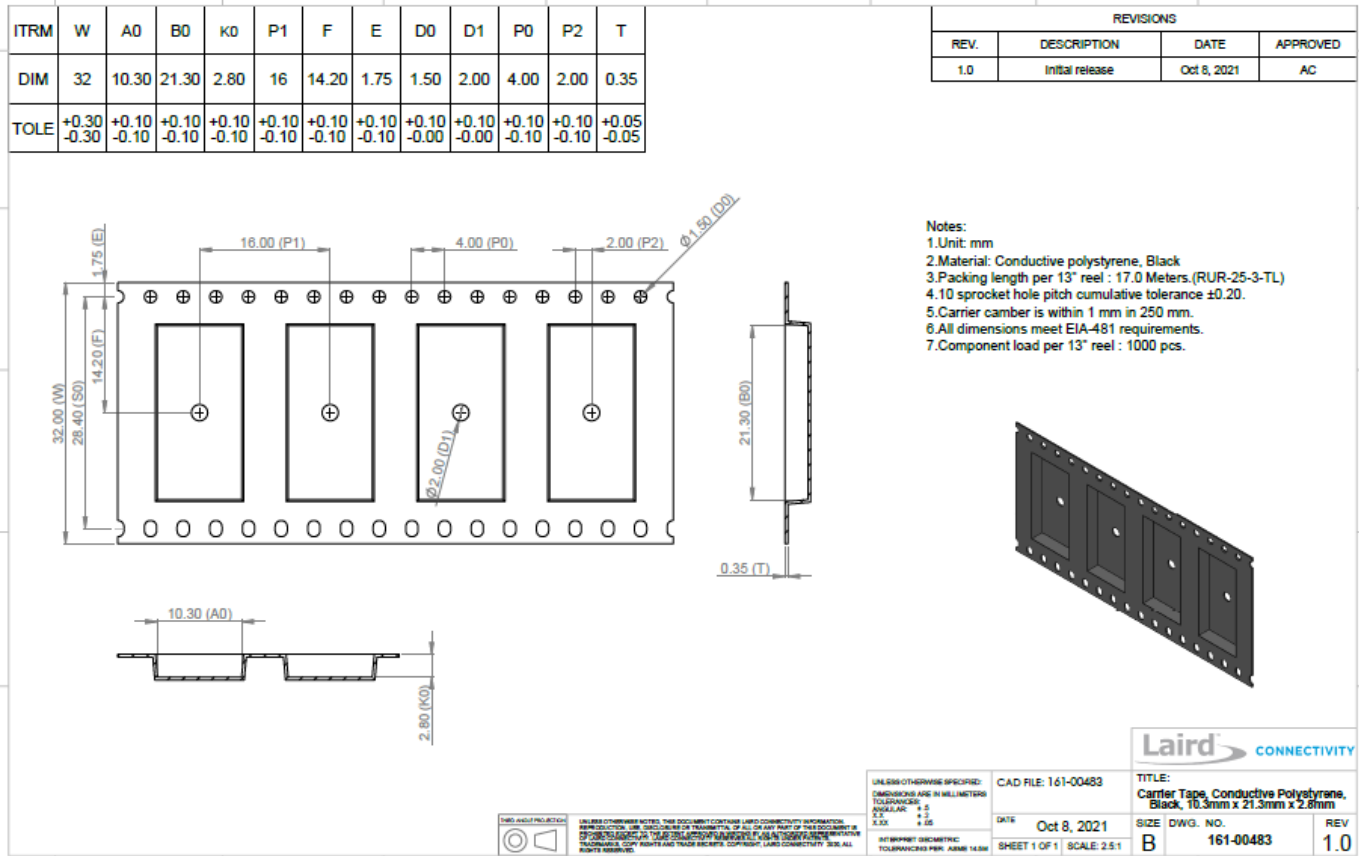


Figure 17: Tape specifications

There are 1,000 x BL5340PA modules taped in a reel (and packaged in a pizza box) and five boxes per carton (5000 modules per carton). Reel, boxes, and carton are labeled with the appropriate labels. See [Carton Contents](#) for more information.

9.2.2 Carton Contents and Packaging Process

The following are the contents of the carton shipped for the BL5340PA modules and the packaging process. The example used here is 453-00076R.

| ITEM NO. | PART NUMBER | REV. | DESCRIPTION | QTY. |
|----------|-------------|------|--|------|
| 1 | 453-00076 | 2.0 | Module, BL5340PA, External Antenna | 1000 |
| 2 | 160-01816 | 1.0 | Label, Blank Moisture Sensitivity Level, 95mm x 80mm | 1 |
| 3 | 160-02268 | 2.0 | Label, Product Identifier, BL5340PA, 60mm x 40mm | 3 |
| 4 | 160-02384 | 1.0 | Label, Carton Product Identifier, BL5340PA, 100mm x 130mm | 2 |
| 5 | 161-00280 | 1.0 | Bag, ESD and Moisture Barrier, Silver, 430mm x 500mm x 0.15mm | 1 |
| 6 | 161-00281 | 1.0 | Humidity Indicator Card, Minimum 60% RH, Six Spot Indication, 38mm x 102mm | 1 |
| 7 | 161-00282 | 1.0 | Desiccant, Silica Gel, 60g, 140mm x 80mm | 1 |
| 8 | 161-00283 | 1.0 | Box, Single-Wall Corrugated B Flute, 376mm x 347mm x 65mm | 1 |
| 9 | 161-00284 | 1.0 | Carton, Double-Wall, Brown, 395mm x 353mm x 374mm | 1 |
| 10 | 161-00418 | 1.0 | Reel, Polystyrene, 330mm Dia. x 32mm, Blue | 1 |
| 11 | 161-00483 | 1.0 | Carrier Tape, Conductive Polystyrene, Black, 10.3mm x 21.3mm x 2.8mm | 1 |
| 12 | 161-00352 | 1.0 | Cover Tape, Anti-static Polyester, 25.5mm x 0.05mm | 1 |

| REVISIONS | | | |
|-----------|--|--------------|----------|
| REV. | DESCRIPTION | DATE | APPROVED |
| 1.0 | Initial release | Oct 12, 2021 | AC |
| 2.0 | Update BL5340PA Module PCB Gerber per Gemtek DFM | Jan 9, 2023 | AC |

Notes:

- Put the Module in the carrier tape and cover the tape.
- Put the Reel, Desiccant and Humidity Indicator Card in the ESD bag.
- Put the packed ESD bag (vacuum) in the box.
- Put five boxes in the carton. (If less than five reels are purchased, insert empty boxes or cardboard to consume the volume of the carton.)
- Module packaging quantity:
 Per Reel: 1000 PCS
 Per Carton: 5000PCS

Labels:

M/N:BL5340PA Rev X

P/N:453-000XXR

D/C:SSYYWWD

Q'TY:1000PCS

BOX_ID:BXXXXXYMDXXXXXX

Figure 18: BL5340PA carton contents and packaging process

9.2.3 Labeling

M/N:BL5340PA Rev X

P/N:453-000XXR

D/C:SSYYWWD

Q'TY:1000PCS

BOX_ID:BXXXXXYMDXXXXXX

Figure 19: Antistatic bag and box labels

The following package label is located on both sides of the master carton:



Figure 20: Master carton package label

9.3 Reflow Parameters

The Moisture Sensitivity Level (MSL) for this module is MSL 4.

Prior to any reflow, it is important to ensure the modules were packaged to prevent moisture absorption. New packages contain desiccant (to absorb moisture) and a humidity indicator card to display the level maintained during storage and shipment. If directed to *bake units* on the card, see Table 47 and follow instructions specified by IPC/JEDEC J-STD-033. A copy of this standard is available from the JEDEC website: <http://www.jedec.org/sites/default/files/docs/jstd033b01.pdf>

Any modules not manufactured before exceeding their floor life should be re-packaged with fresh desiccant and a new humidity indicator card. Floor life for MSL (Moisture Sensitivity Level) four devices is 72 hours in ambient environment $\leq 30^{\circ}\text{C}/60\%\text{RH}$.

Table 47: Recommended baking times and temperatures

| MSL | 125°C Baking Temp. | | 90°C/≤ 5%RH Baking Temp. | | 40°C/ ≤ 5%RH Baking Temp. | |
|-----|----------------------------|--|-----------------------------|--|------------------------------|--|
| | Saturated @ 30°C/85% | Floor Life Limit + 72 hours @ 30°C/60% | Saturated @ 30°C/85% | Floor Life Limit + 72 hours @ 30°C/60% | Saturated @ 30°C/85% | Floor Life Limit + 72 hours @ 30°C/60% |
| 4 | 11 hours | 7 hours | 37 hours | 23 hours | 15 days | 9 days |

Laird Connectivity surface mount modules are designed to be easily manufactured, including reflow soldering to a PCB. Ultimately it is the responsibility of the customer to choose the appropriate solder paste and to ensure oven temperatures during reflow meet the requirements of the solder paste. Laird Connectivity surface mount modules conform to J-STD-020D1 standards for reflow temperatures.

Important: During reflow, modules should not be above 260° and not for more than 30 seconds. In addition, we recommend that the BL5340PA module **does not** go through the reflow process more than one time; otherwise, the BL5340PA internal component soldering may be impacted.

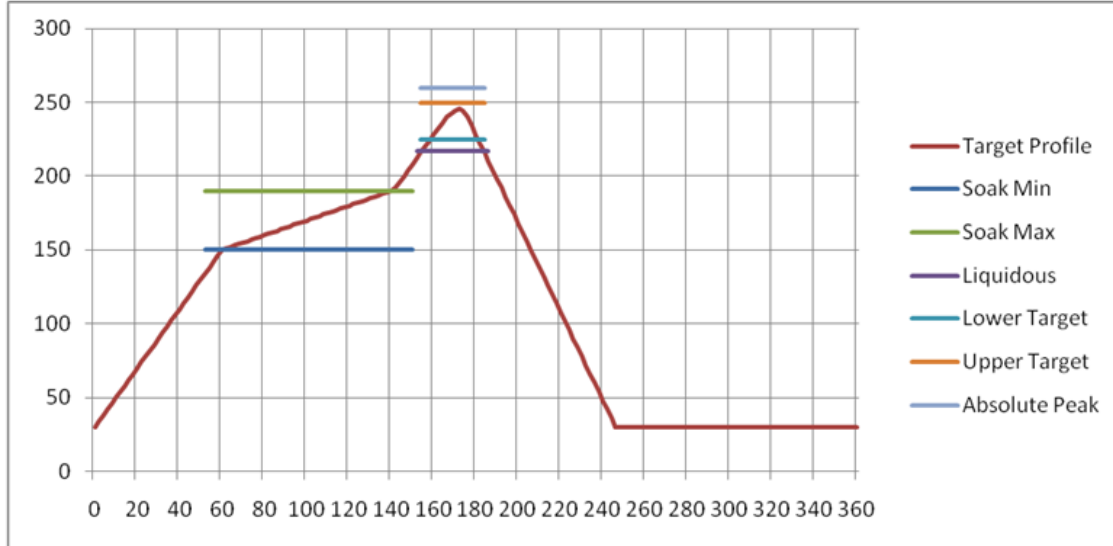


Figure 21: Recommended reflow temperature

Temperatures should not exceed the minimums or maximums presented in [Table 48](#).

Table 48: Recommended maximum and minimum temperatures

| Specification | Value | Unit |
|------------------------------------|--------|----------|
| Temperature Inc./Dec. Rate (max) | 1~3 | °C / Sec |
| Temperature Decrease rate (goal) | 2-4 | °C / Sec |
| Soak Temp Increase rate (goal) | .5 - 1 | °C / Sec |
| Flux Soak Period (Min) | 70 | Sec |
| Flux Soak Period (Max) | 120 | Sec |
| Flux Soak Temp (Min) | 150 | °C |
| Flux Soak Temp (max) | 190 | °C |
| Time Above Liquidous (max) | 70 | Sec |
| Time Above Liquidous (min) | 50 | Sec |
| Time In Target Reflow Range (goal) | 30 | Sec |
| Time At Absolute Peak (max) | 5 | Sec |
| Liquidous Temperature (SAC305) | 218 | °C |
| Lower Target Reflow Temperature | 240 | °C |
| Upper Target Reflow Temperature | 250 | °C |
| Absolute Peak Temperature | 260 | °C |

10 REGULATORY

Note: For complete regulatory information, refer to the BL5340PA Regulatory Information document available from the BL5340PA product page.

The BL5340PA holds current certifications in the following countries:

| Country/Region | Regulatory ID |
|----------------|----------------|
| USA (FCC) | SQGBL5340PA |
| Canada (ISED) | 3147A-BL5340PA |
| Australia | N/A |
| New Zealand | N/A |

10.1 Federal Communication Commission Interference Statement

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

Radiation Exposure Statement:

The product complies with the US portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/CANADA

The module is limited to OEM installation only.

Integration instructions for host product manufacturers

Applicable FCC rules to module

FCC Part 15.247

Summarize the specific operational use conditions

The module is must be installed in mobile device.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Limited module procedures

Not applicable

Trace antenna designs

Not applicable

RF exposure considerations

Co-located issue shall be met as mentioned in "Summarize the specific operational use conditions". Product manufacturer shall provide below text in end-product manual "Radiation Exposure Statement:

The product comply with the US portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.."

| Manufacturer | Model | Laird Connectivity Part Number | Type | Connector | Peak Gain | |
|--------------------|------------------------|---|------------|------------|---------------|---------------|
| | | | | | 2400-2500 MHz | 2400-2480 MHz |
| Laird Connectivity | NanoBlue | EBL2400A1-10MH4L | PCB Dipole | IPEX MHF4L | 2 dBi | - |
| Laird Connectivity | FlexPIFA | 001-0022 | PIFA | IPEX MHF4 | - | 2 dBi |
| Mag.Layers | EDA-8709-2G4C1-B27-CY | 0600-00057 | Dipole | IPEX MHF4 | 2 dBi | - |
| Laird Connectivity | mFlexPIFA | EFA2400A3S-10MH4L | PIFA | IPEX MHF4L | - | 2 dBi |
| Laird Connectivity | iFlexPIFA | EFG2400A3S-10MH4L | PIFA | IPEX MHF4L | - | 3.1 dBi |
| Laird Connectivity | Laird Connectivity NFC | 0600-00061 | NFC | N/A | - | - |
| Laird Connectivity | PCB Trace Antenna | Not applicable (BL5340 PCB Trace Antenna) | PCB | N/A | 1.49dBi | |

Label and Compliance Information

Product manufacturers need to provide a physical or e-label stating
“Contains FCC ID: SQGBL5340PA” with finished product

Information on Test Modes and Additional Testing Requirements

Test tool: **BL5340PA_radio_test_fem_module_v00.00.03** shall be used to set the module to transmit continuously.

Additional Testing, Part 15 Subpart B Disclaimer

The module is only FCC authorized for the specific rule parts listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed

10.2 Industry Canada Statement

(1) *This device may not cause interference*

(2) *This device must accept any interference, including interference that may cause undesired operation of the device*

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;

(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter [IC: 3147A-BL5340PA] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio [IC: 3147A-BL5340PA] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

| Manufacturer | Model | Laird Connectivity Part Number | Type | Connector | Peak Gain | |
|--------------------|------------------------|---|------------|------------|---------------|---------------|
| | | | | | 2400-2500 MHz | 2400-2480 MHz |
| Laird Connectivity | NanoBlue | EBL2400A1-10MH4L | PCB Dipole | IPEX MHF4L | 2 dBi | - |
| Laird Connectivity | FlexPIFA | 001-0022 | PIFA | IPEX MHF4 | - | 2 dBi |
| Mag.Layers | EDA-8709-2G4C1-B27-CY | 0600-00057 | Dipole | IPEX MHF4 | 2 dBi | - |
| Laird Connectivity | mFlexPIFA | EFA2400A3S-10MH4L | PIFA | IPEX MHF4L | - | 2 dBi |
| Laird Connectivity | iFlexPIFA | EFG2400A3S-10MH4L | PIFA | IPEX MHF4L | - | 3.1 dBi |
| Laird Connectivity | Laird Connectivity NFC | 0600-00061 | NFC | N/A | - | - |
| Laird Connectivity | PCB Trace Antenna | Not applicable (BL5340 PCB Trace Antenna) | PCB | N/A | 1.49dBi | |

Radiation Exposure Statement:

The product comply with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aux radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 1 condition above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

1) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains IC: 3147A-BL5340PA".

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 3147A-BL5340PA".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

11 ORDERING INFORMATION

| Part Number | Product Description |
|--------------|---|
| 453-00068R | BL5340PA series - Multi-Core / Protocol - Bluetooth® + 802.15.4 + NFC Module (Nordic nRF5340) – Integrated antenna (Tape/Reel) |
| 453-00076R | BL5340PA series - Multi-Core / Protocol - Bluetooth® + 802.15.4 + NFC Module (Nordic nRF5340) – MHF4 RF receptacle connector (Tape/Reel) |
| 453-00068C | BL5340PA series - Multi-Core / Protocol - Bluetooth® + 802.15.4 + NFC Module (Nordic nRF5340) – Integrated antenna (Cut Tape) |
| 453-00076C | BL5340PA series - Multi-Core / Protocol - Bluetooth® + 802.15.4 + NFC Module (Nordic nRF5340) – MHF4 RF receptacle connector (Cut Tape) |
| 453-00068-K1 | Development kit for BL5340PA Multi-Core / Protocol - Bluetooth® + 802.15.4 + NFC Module (Nordic nRF5340) – Integrated antenna |
| 453-00076-K1 | Development kit for BL5340PA Multi-Core / Protocol - Bluetooth® + 802.15.4 + NFC Module (Nordic nRF5340) - MHF4 RF receptacle connector (Ext antenna) |

12 BLUETOOTH SIG QUALIFICATION

12.1 Overview

The BL5340PA module is listed on the Bluetooth SIG website as a qualified End Product, using the combination of a Controller and Host Subsystem combination

| Design Name | Owner | Declaration ID | Reference QDID | Link to listing on the SIG website |
|-------------|-----------------------|----------------|----------------|------------------------------------|
| BL5340PA | Laird Connectivity | | | |

12.1.1 Referenced Qualified Subsystems

| Design Name | Owner | Reference QDID | Link to listing on the SIG website |
|-----------------------------------|-----------------------------|----------------|------------------------------------|
| LE Controller Subsystem | Nordic Semiconductor ASA | | |
| nRF Connect SDK Host Subsystem | Nordic Semiconductor ASA | | |

It is a mandatory requirement of the Bluetooth Special Interest Group (SIG) that every product implementing Bluetooth technology has a Declaration ID. Every Bluetooth design is required to go through the qualification process, even when referencing a Bluetooth Design that already has its own Declaration ID. The Qualification Process requires each company to registered as a member of the Bluetooth SIG – <https://www.bluetooth.com/>

The following link provides a link to the Bluetooth Registration page: <https://www.bluetooth.org/login/register/>

For each Bluetooth Design, it is necessary to purchase a Declaration ID. This can be done before starting the new qualification, either through invoicing or credit card payment. The fees for the Declaration ID will depend on your membership status, please refer to the following webpage:

<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing/qualification-listing-fees/>

For a detailed procedure of how to obtain a new Declaration ID for your design, please refer to the following SIG document:

https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=283698&vld=317486

12.2 Qualification Steps When Referencing Qualified Subsystems

For this qualification, follow these steps:

- To start a listing, go to: https://www.bluetooth.org/tpg/QLI_SDoc.cfm
- Select **Start the Bluetooth Qualification Process with No Required Testing**.
- Project Basics:
 - Enter the Project Name (this can be the product name or the Bluetooth Design name).
 - For Referenced Qualified Designs, enter QDID XXXX and XXXXXX
- Product Declaration:
 - Enter the Listing Date (this can any date ranging from the date of entry up to 90 days after submission) – Your design is qualified immediately but the listing does not go public until the specified date.
- Add End Product(s) – Each end product that uses the Qualified Design (without modification) can be added in this section. The Bluetooth SIG requires that you add each individual model number separately.
- Declaration ID:
 - Select a Declaration ID from the list.

Important! To complete this step, you must have already paid your Bluetooth SIG Declaration ID fee. If you have not, refer to the Bluetooth SIG Qualification Overview section for instructions. You also have the option of clicking **Pay Declaration Fee** accessible from this step of the Bluetooth SIG Qualification process.

7. Review and Submit – With this, some automatic checks occur to ensure all sections are complete.
 - Review all entered information and make corrections, if needed.
 - Once you have reviewed your information, tick all of the check boxes and add your name to the signature page.
 - Click **Signature Confirmed – Complete Project & Submit Product(s) for Qualification**.

For further information, please refer to the following webpage:
<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing/>

13 RELIABILITY TESTS

The BL5340PA module went through the below reliability tests and passed.

| Test Sequence | Test Item | Test Limits and Pass | Test Conditions | |
|---------------|------------------|---|----------------------------------|--|
| 1 | Vibration Test | JESD22-B103B Vibration, Variable frequency | Sample | Unpowered |
| | | | Sample Number | 3 |
| | | | Vibration Waveform | Sine waveform |
| | | | Vibration Frequency/Displacement | 20 to 80 Hz/20 g |
| | | | Vibration Frequency/Acceleration | 80 to 2000 Hz/20 g |
| | | | Cycle Time | 4 minutes |
| | | | Number of Cycles | 4 cycles per axis |
| | | | Vibration Axis | X, Y, and Z (rotating each axis on vertical vibration table) |
| 2 | Mechanical Shock | JESD22-B104C | Sample | Unpowered |
| | | | Sample Number | 3 |
| | | | Pulse Shape | Half-sine waveform |
| | | | Impact Acceleration | 1500 g |
| | | | Pulse Duration | 0.5 ms |
| | | | Number of Shocks | 30 shocks (5 shocks for each face) |
| | | | Orientation | Bottom, top, left, right, front, and rear faces |
| 3 | Thermal Shock | JESD22-A104E Temperature cycling | Sample | Unpowered |
| | | | Sample Number | 3 |
| | | | Temperature Transition Time | Less than 30 seconds |
| | | | Temperature Cycle | -40°C (10 minutes), +105°C (10 minutes) |
| | | | Number of Cycles | 350 |

Before and after the testing, visual inspection showed no physical defect on samples.

After Vibration test and Mechanical Shock testing, the samples were functionally tested, and all samples functioned as normal. Then after Thermal shock test, the samples were functionally tested, and all samples functioned as normal.

ADDITIONAL ASSISTANCE

Please contact your local Laird Connectivity sales representative or our support team for further assistance:

Support Center <https://www.lairdconnect.com/resources/support>

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Europe: +44-1628-858-940
Hong Kong: +852 2762 4823

Web <https://www.lairdconnect.com/wireless-modules>

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