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BL54H20 Series Multi Core Bluetooth LE 802.15.4 NFC Module

ezurio BL54H20 Series Multi Core Bluetooth LE 802.15.4 NFC Module Owner's Manual

Contents

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Specifications

- Product: BL54H20 Series
- Version: 1.0
- Release Date: 5 Dec 2024

Product Information

The BL54H20 Series is a high-performance wireless module designed for various applications that require reliable communication. With features like External Antenna Integration, Chip Antenna Performance, and a Maximum Transmit Power Setting of 7dBm, this module offers flexibility and efficiency in wireless connectivity.

Product Usage Instructions

Overview and Key Features

- **Features and Benefits:** The BL54H20 Series offers advanced features such as External Antenna Integration, Chip Antenna Performance, and a Maximum Transmit Power Setting of 7dBm, ensuring reliable wireless communication.
- **Application Areas:** This module is suitable for a wide range of applications that require wireless connectivity, including IoT devices, smart home systems, and industrial automation.

Specification

Specification Summary: The module's specifications include high-performance wireless communication capabilities, External Antenna Integration support, Chip Antenna Performance, and a Maximum Transmit Power Setting of 7dBm.

Hardware Specifications

Block Diagram and Pin-out

The block diagram and pin-out information provide details on the module's physical layout and pin connections for easy integration into host systems.

Pin Definitions

The pin definitions outline the functions of each pin on the module, facilitating proper connection and configuration for optimal performance.

Electrical Specifications

Absolute Maximum Ratings: Ensure that the module operates within the specified electrical limits to prevent damage and maintain reliable operation.

FAQ

- **Q: What is the recommended operating temperature range for the BL54H20 Series?**
  - **A:** The recommended operating temperature range for the BL54H20 Series is -40°C to +85°C.
- **Q: Can the BL54H20 Series be used in outdoor environments?**
  - **A:** Yes, the BL54H20 Series is designed to withstand outdoor environments with proper protection against moisture and extreme temperatures.

Revision History

Version	Date	Notes	Contributor(s)	Approver
0.1	02 Oct 2024	Initial PRELIMINARY release.	Raj Khatri	Jonathan Kaye
0.2	16 Oct 2024	Added **External Antenna Integration with BL54H20 MHF4 variant (453-00198)**	Raj Khatri	Jonathan Kaye
0.3	25 Oct 2024	Added Ignion NN02-101 chip antenna part number into section **PCB Layout on Host PCB for the 453-0019x**	Raj Khatri	Jonathan Kaye
0.4	22 Nov 2024	Add **Chip Antenna Performance** Modify Maximum Transmit Power Setting in **Specification Summary** to 7dBm	Louis Chang	Jonathan Kaye
0.5	5 Dec 2024	Modify some incorrect comment in 3.2 Pin Definition Add partial sensitivity value	Louis Chang	
1.0	5 Dec 2024	Initial release.	Dave Drogowski	Jonathan Kaye

Overview and Key Features

The newest entry in our Nordic Semiconductor based Bluetooth LE portfolio is by far the most advanced, most

secure, and highest performing multi core MCU architecture wireless solution available anywhere. The BL54H20 series of robust, tiny modules feature the Nordic nRF54H20 SoC. It directly targets the highest-performance processing capabilities with double the application processing (vs. prior BL5340). 2x Cortex-M33 AND 2x RISC-V coprocessors each are optimized for particular workloads. We've also scaled up memory to 2MB non-volatile and 1MB RAM. Featuring BT 5.4, capabilities include support for Bluetooth LE, LE Audio, Bluetooth Mesh, and 802.15.4 protocols including Thread and Matter.It's further enhanced with state-of-the-art security, designed for PSA Certified level 3, and supports Secure Boot, Secure Firmware Update, Secure Storage, and integrated tamper sensors for physical security. The BL54H20 series brings out all nRF54H20 hardware features and capabilities including high speed USB access, CAN FD controller, 2 x I3C and 14bit ADC, up to +10 dBm transmit power, from 1.9V to 5.5V supply considerations, and a true industrial operating range of -40 to 105°C. Complete regulatory certifications enable faster time to market and reduced development risk, simplifying your next wireless design.

Note: BL54H20 hardware provides all functionality of the nRF54H20 chipset used in the module design. This is a hardware datasheet only – it does not cover the software aspects of the BL54H20. This is to acknowledge that information in this datasheet is referenced from the nRF54H20 datasheet.

Features and Benefits

- Nordic nRF54H20 – 4.7xmm4.3 WSCLP with 64 GPIOs available.
- Multi-protocol support: Bluetooth 5.4 LE, 802.15.4 (Thread/Matter)
- Bluetooth LE: Peripheral/Central, 2 Mbps (high throughput), LE Coded (long range), AoA/AoD, LE Audio/Isochronous Channels, Mesh
- Dual Cortex M33 processor cores: Application processor (up to 320MHz Cortex M33), Radio processor (256MHz Cortex M33)
- Dual RISC-V co-processor cores: 320 MHz VPR, 16 MHz VPR
- Memory: 2MB non-volatile memory, 768 KB RAM, and External interfaces – XIP, QSPI, xSPI, HyperBus
- Extended Industrial Temperature Rating (-40° to +105°C)
- Small form factor: 13.5 x 10 x 1.8 mm
- Most configurable interfaces: – NFC A-Tag, USB, CAN FD, I3C, UART, QSPI, SPI, High Speed SPI, SMIF, I2S, I2C, PDM, PWM, ADC, GPIO, QDEC,Comparator, Low Power Comparator
- Additional SoC Hardware Features like RNG, WDT, temperature sensor, floating point unit, inter-processor communication, debug trace, NFC
- Antenna choice –external antenna support via MHF4 connector OR integrated pre-certified Chip antenna
  - Ignion NANO NN02
- Development choice: Zephyr RTOS,Nordic nRF Connect SDK, Canvas Software Suite
- Firmware Over the Air (FOTA) via MCUboot and Zephyr
- Hostless operation – Multi Core MCU reduces BOM
- Fully featured development kits to jump start Bluetooth LE development

Application Areas

- Smart Building
- Asset Tracking
- Secure Medical Peripherals
- Industrial Automation

Specification

Specification Summary

Categories/Feature	Implementation
Wireless Specification	
Bluetooth®	Bluetooth 5.4 – Single mode · GATT client/server – Any adopted/custom services · Central/Peripheral roles · Bluetooth LE mesh · 2M PHY · LE Coded PHY · LE Audio w/ Isochronous streams · AoA / AoD · LE Advertising Extensions · LE secure connections · Data packet length extensions · LE privacy v1.2 · DTM Firmware (Test Modes)
IEEE 802.15.4-2006 PHY	2405–2480 MHz IEEE 802.15.5-2006 radio transceiver, implementing IEEE 802.15.5-2006 compliant · 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 (*not currently certified by Ezurio*)	2402–2480 MHz Nordic proprietary 1Mbps and 2Mbps modes radio transceiver · 1Mbps nRF proprietary mode (ideal transmitter) · 2Mbps nRF proprietary mode (ideal transmitter) · 4Mbps 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, 2Mbps and 4Mbps modes (over-the-air)
Maximum Transmit Power Setting	+7 dBm Conducted 453-000197 (Integrated antenna), (Exclude antenna gain) +7 dBm Conducted 453-000198 (External antenna), (Test at MHF4 connector)
Minimum Transmit Power Setting	TBD
Receive Sensitivity (≤37byte packet for BLE)1	BLE 1 Mbps (BER=1E-3) -97 dBm typical BLE 2 Mbps -94 dBm typical BLE 125 kbps -105 dBm typical BLE 500 kbps -100 dBm typical IEEE 802.15.4-2006 250kbps -TBD dBm typical
Link Budget (conducted)	TBD dB @ BLE 1 Mbps TBD dB @ BLE 125 kbps

NFC	
NFC-Tag A Listen mode compliant	**Based on NFC forum specification:** 13.56 MHz, Date rate 106 kbps, NFC Type2 and Type 4 emulation **Modes of Operation:** Disable, Sense, Activated **Use Cases:** Touch-to-Pair with NFC, NFC enabled Out-of-Band Pairing System Wake-On-Field function: Proximity Detection

Peripherals Domain	Co-processor High Speed Core _____	Co-processor Low Leakage Core _____	Application Core	Radio Core	Security Core
Global Domain					

	FLPR "Flipper" Viper Risc-V 320MHz 64KB RAM 2048KB MRAM	PPR "Pepper" Viper Risc-V 16MHz 64KB RAM	Arm Cortex M33 320MHz Max 32 KB RAM, DVFS L1 I-cache L1 D-cache TrustZone, FPU, DSP.	Arm Cortex M33 256MHz Max Fast Start-Stop. 192KB RAM L1 I-cache L1 D-cache TrustZone, FPU, DSP	Arm Cortex M33 DVFS. 32kB RAM. Designed for PSA Level 3. Secure boot, secure FW
Two co-processors					
Total	64 x multifunction I/O lines				
GPIO	14x 1.8V 200MHz GPIO's. 8x 1.8V 100MHz GPIO's.	6x 1.8-3.6V 16MHz GPIO's. 36x 1.2-1.8V 16MHz GPIO's.			
EXMIF (External Memory Interface)	1x EXMIF interface XiP capable, supports SPI, QPSI, xSPI, Hyperbus upto 400MB/s. Max clock 200MHz				
HS-USB 2.0	1x 480Mbps				
I3C	2x I3C (33.4Mbps) Master, slave or Multimaster				
CAN		1x			
Global RTC		1x System Timer 1us resolution 52bits wide			
HS-SPIM	1x (64MHz)				
HS-SPIS	1x (64MHz)				
HS-SPIM-UART	1x				
HS-PWM	1x 8 channel PWM (160MHz)				

PWM	2x runs 320MHz	4x 4 channel PWM (16MHz). 8channel			
Timer	2x runs 320MHz	6x runs 16MHz			
SMIF		1x works with external ISO7816 standard			
I2S, TDM		1x			
PDM		1x			
Audio PLL		1x Optional clock source for PDM, I2S, TDM audio interfaces. Incoming BLE audio.			
QDEC (Quadrature decoder)		2x			
SPI, I2C, UART		8x			
ADC (200kbps)		1xSAADC on GPIO port P1 or P9. P9 can use voltage division. 3 modes: 10-bit 4MS/s 12-bit 125kS/s			

Peripherals Domain	Co-processor High Speed Core	Co-processor Low Leakage Core	Application Core	Radio Core	Security Core
	Global Domain				
		14-bit 31.25kS/s Upto 8channels AIN0-AIN7			
COMP		1 x COMP (comparator)			
LPCOMP		1 x LPCOMP (low power comparator) can wake from System OFF			
NFC A-Tag		1x NFC A-Tag			
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 nRF54L15 internal load capacitor, which is configurable as TBD pF to TBD pF in TBDpF steps on pins XL1, XL2.			
Security					Designed for PSA Certified Level 3 with Secure Boot, Secure Firmware Update, and Secure Storage. Integrated tamper sensors detect attacks and take action, and cryptographic accelerators are hardened against side-channel attacks.

Programmability	
Programming Options	**Nordic nRF Connect SDK:** Software/Support available from Nordic directly: https://devzone.nordicsemi.com/ **Zephyr RTOS:** Software/Support available from Nordic directly: https://www.zephyrproject.org/ **Canvas SW Suite:** Software/ Support available from https://www.ezurio.com/canvas/software-suite
FW upgrade	Via UART, SWD, or Bluetooth LE – via nRF Connect SDK or Zephyr

Supply Voltage	
Supply Voltage	High Voltage Mode (VDD_HV): 1.9 - 5.5V (Internal DCDC convertor or LDO) Normal Voltage Mode (VDD_VDD_HV): 1.8V

Power Consumption	
Active Modes Peak Current (for maximum Tx power +10 dBm) – Radio only	TBD mA peak Tx (with DCDC)
Active Modes Peak Current (for Tx power -TBD dBm) – Radio only	TBD mA peak Tx (with DCDC)
Active Modes Average Current	Depends on many factors (e.g. BLE Advertising interval BLE connection interval etc..)
Ultra-low Power Modes	System ON Idle TBD uA (wake on any event) System OFF 0.6 uA (with GPIO wake up on 12pins)

Antenna Options	
Internal	Chip antenna – on-board (**453-00197 variant**)
External	Connection via *on module* IPEX MHF4 – **453-00198 variant**

Physical	
Dimensions	13.5mm x 10mm x 1.8mm Pad Pitch – 0.65 mm Pad Type – Three rows of pads (LGA - Land Grid Array).
Weight	<1 gram

Environmental	
Operating	-40 ˚C to +105 ˚C

- Nordic nRF Connect SDK: Software/Support available from Nordic directly: **https://devzone.nordicsemi.com/**
- Zephyr RTOS: Software/Support available from Nordic directly: **https://www.zephyrproject.org/**
- Canvas SW Suite: Software/ Support available from **https://www.ezurio.com/canvas/software-suite**

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 (453-00197-K1 and 453-00198-K1 respectively)
Development Tools	Nordic nRF Connect – Android and iOS applications XBit Tools & Utilities
Bluetooth®	Full Bluetooth SIG Declaration ID
FCC/ISED/CE/MIC/RCM/ UKCA	All BL54H20 Series

Hardware Specifications
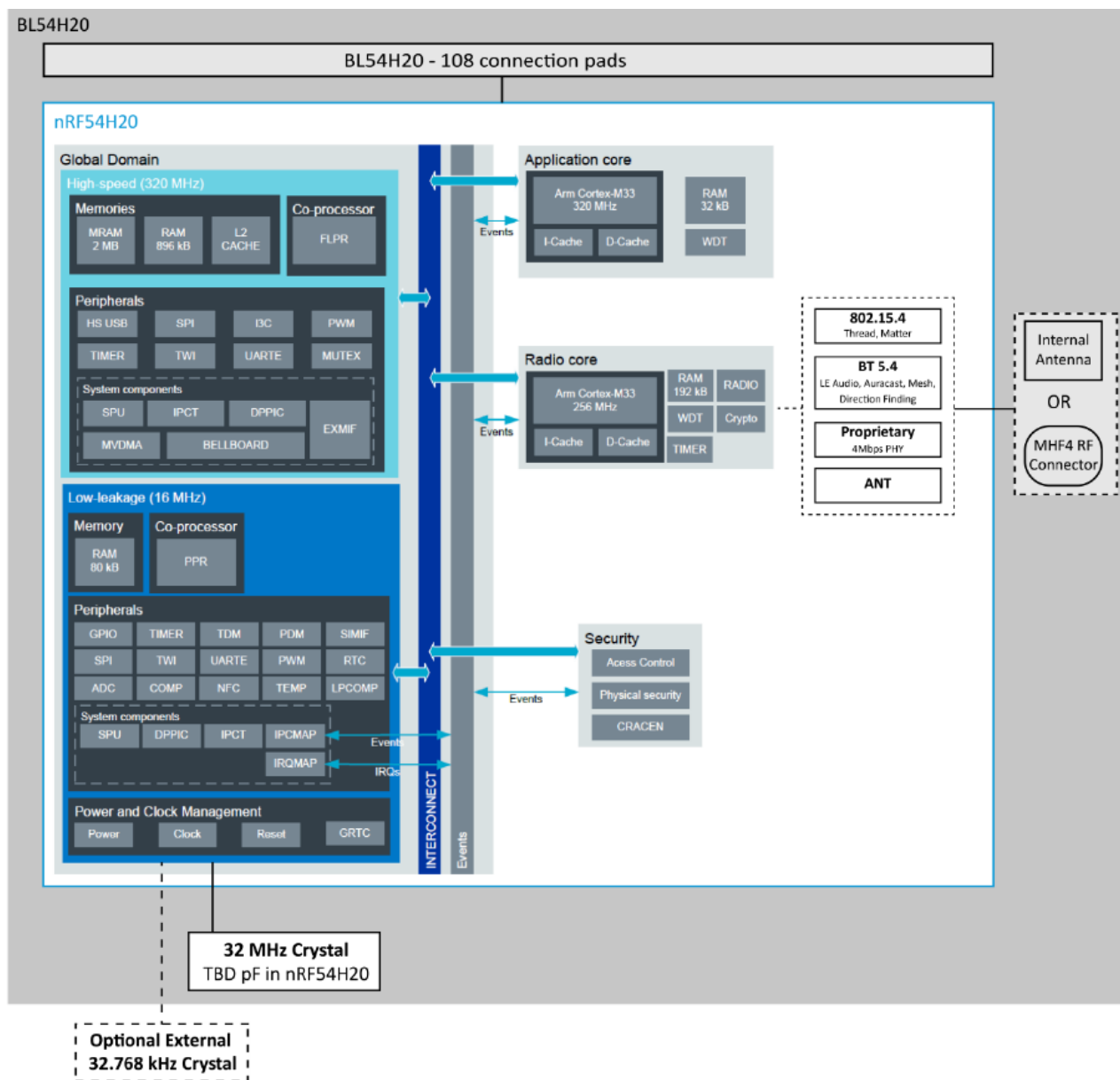
Block Diagram and Pin-out

Figure 1: BL54H20 HW block diagram

Figure 2: Top view - Schematic symbol for 453-00197 BL54H20 Multi-Core/Protocol -Bluetooth +802.15.4+NFC Module (Nordic nRF54H20) - Integrated Antenna (Ignion chip antenna) or MHF4 RF connector variant 453-00198

Figure 2: Top view – Schematic symbol for 453-00197 BL54H20 Multi-Core/Protocol -Bluetooth +802.15.4+NFC Module (Nordic nRF54H20) – Integrated Antenna (Ignion chip antenna) or MHF4 RF connector variant 453-00198

Pin Definitions

Table 1: Pin definitions

Pin #	Pin Name	nRF54H20 WLCSP Pin	nRF54H20 WLCSP Name	Comment	If Not Used
1	GND	–	VSS		
2	P1.03/AIN3	E5	P1.03/AIN3	Ezurio Devkit: MikroE I2C SCL and PMIC I2C SCL	
3	P1.04/AIN4	D5	P1.04/AIN4	Ezurio Devkit: MikroE I2C SDA and PMIC I2C SDA	
4	P1.02/AIN2	E4	P1.02/AIN2		
5	P1.01/AIN1	D4	P1.01/AIN1	Ezurio Devkit: MikroE Reset	
6	P1.08/AIN_EXT_REF	D6	P1.08/AIN_EXT_REF		
7	P1.05/AIN5	C5	P1.05/AIN5		
8	P1.00/AIN0	B4	P1.00/AIN0	Ezurio Devkit: MikroE Analog	
9	P1.11	C6	P1.11	Ezurio Devkit: UART1_TXD (output)	
10	P1.06/AIN6	B5	P1.06/AIN6		
11	P1.10	B6	P1.10	Ezurio Devkit: UART1_RXD (input)	
12	P1.09	A6	P1.09	Ezurio Devkit: UART1_RTS (output)	
13	P1.07/AIN7	A5	P1.07/AIN7	Ezurio Devkit: UART1_CTS (input)	
14	GND		VSS		
15	VBUS	A9	VBUS	VBUS USB supply voltage 4.4V-5.5V. MUST fit 10uF to GND.	
16	P9.03	B10	P9.03	Ezurio Devkit: LED5	
17	P9.01	A10	P9.01	Ezurio Devkit: LED3	
18	GND				
19	P9.02	B11	P9.02	Ezurio Devkit: LED4	
20	P9.05	C10	P9.05		
21	VDDIO_P1	A4	VDDIO_P1	External supply for GPIO port P1.	

Pin #	Pin Name	nRF54H20 WLCSP Pin	nRF54H20 WLCSP Name	Comment	If Not Used
				1.8V typical (1.62V-1.98V).	
22	P9.04	C11	P9.04	–	
23	P9.00	A11	P9.00	Ezurio Devkit: LED2	

24	P0.11	G9	P0.11	Ezurio Devkit: BUTTON4	
25	D+	B7	D+		
26	P0.10	F9	P0.10	Ezurio Devkit: BUTTON3	
27	P0.07	E9	P0.07	–	
28	D-	B8	D-		
29	P0.04	D8	P0.04	–	
30	P0.00	C9	P0.00	–	
31	GND		VSS		
32	P0.03	D9	P0.03	–	
33	GND		VSS		
34	P0.06	E10	P0.06	–	
35	P0.09	F10	P0.09	Ezurio Devkit: BUTTON2	
36	VDDIO_P9	A12	VDDIO_P9	External supply for 3V GPIO port P9. 3.3V typical (1.62-3.6V).	
37	P0.01	D11	P0.01	–	
38	P0.02	D10	P0.02	–	
39	XL1	B12	XL1	Ezurio Devkit: Optional 32.768kHz crystal pad XL2 and associated 9pF load capacitor inside nRF54H20 chipset	
40	GND		VSS		
41	XL2	C12	XL2	Ezurio Devkit: Optional 32.768kHz crystal pad XL2 and associated 9pF load capacitor inside nRF54H20 chipset	
42	VDD_EXT	D12	VDD_EXT	Power output	
43	P0.05	E11	P0.05	–	
44	P0.08	F11	P0.08	Ezurio Devkit: BUTTON1	
45	SWDCLK	F12	SWDCLK	Serial Wire Debug clock input for debug and programming	
46	VDDIO_P7	J12	VDDIO_P7	External supply for GPIO port P7. 1.8V typical (1.62V-1.98V).	
47	SWDIO	G12	SWDIO	Serial Wire Debug IO for debug and programming	
48	GND		VSS	–	
49	NRESET	H12	NRESET	Pin RESET with internal pull-up resistor (13k Ohms). System Reset (Active Low).	

Pin #	Pin Name	nRF54H20 WLCSP Pin	nRF54H20 WLCSP Name	Comment	If Not Used
50	VDDIO_P6	K8, K9, K19, K11	VDDIO_P6	External supply for GPIO port P6. 1.8V typical (1.62V-1.98V).	
51	P6.03/CS0	K12	P6.03/CS0	Recommended usage EXMIF CS0.	
52	P6.04/DQ7	L11	P6.04/DQ7	Recommended usage EXMIF DQ7.	
53	P6.01/CKN	L12	P6.01/CKN		
54	P6.00/CK	M12	P6.00/CK	Recommended usage EXMIF CK.	
55	P6.02/RWDS	M11	P6.02/RWDS	Recommended usage EXMIF DQS.	
56	P6.05/DQ1	M10	P6.05/DQ1	Recommended usage EXMIF DQ1.	
57	GND		VSS		
58	P6.06/DQ6	L10	P6.06/DQ6	Recommended usage EXMIF DQ6.	
59	P6.08/DQ5	L9	P6.08/DQ5	Recommended usage EXMIF DQ5.	
60	P6.07/DQ0	M9	P6.07/DQ0	Recommended usage EXMIF DQ0.	
61	P6.11/DQ4	M7	P6.11/DQ4	Recommended usage EXMIF DQ4.	
62	P6.09/DQ3	M8	P6.09/DQ3	Recommended usage EXMIF DQ3.	
63	P6.12/RESETN	L7	P6.12/RESETN	Recommended usage EXMIF RESETN.	

Pin #	Pin Name	nRF54H20 WLCSP Pin	nRF54H20 WLCSP Name	Comment	If Not Used
64	P6.10/DQ2	L8	P6.10/DQ2	Recommended usage EXMIF DQ2.	

Pin #	Pin Name	nRF54H20 WLCSP Pin	nRF54H20 WLCSP Name	Comment	If Not Used
65	P6.13/CS1	K7	P6.13/CS1	.	
66	P7.06	J10	P7.06	Ezurio Devkit: MikroE SPI PWM (default no connection) and TRACE DATA2	
67	P7.05	J11	P7.05	Ezurio Devkit: MikroE SPI PWM (default connection) and TRACE DATA1	
68	P7.02	H11	P7.02	Ezurio Devkit: MikroE SPI CLK	
69	P7.03	H10	P7.03	Ezurio Devkit: TRACE CLK	
70	P7.01	G10	P7.01	Ezurio Devkit: MikroE SPI MOSI	
71	P7.00	G11	P7.00	Ezurio Devkit: MikroE SPI MISO	
72	P7.04	H9	P7.04	Ezurio Devkit: TRACE DATA0 and MilroE SPI CS	

73	P7.07	J9	P7.07	Ezurio Devkit: TRACE DATA3
74	P2.03	H3	P2.03	Ezurio Devkit: MikroE INT
75	P2.05	J3	P2.05	Ezurio Devkit: UART0_CTS (input)
76	P2.07	K3	P2.07	Ezurio Devkit: UART0_RTS (output)
77	VDD_HV	L1	VDD_HV	Main Supply input 1.9V-5.5V for High Voltage Mode where connect external supply to VDD_HV and pin104(VDD_1V8) becomes an output supply (1.8 V). MUST fit 10uF to GND.
78	P2.08	K2	P2.08	Ezurio Devkit: MikroE UART RX
79	P2.06	J2	P2.06	Ezurio Devkit: UART0_TXD
80	GND		VSS	
81	P2.04	H2	P2.04	Ezurio Devkit: UART0_RXD
82	P2.09	K1	P2.09	Ezurio Devkit: MikroE UART TX
83	VDDIO_P2	G1	VDDIO_P2	External supply for GPIO port P2. 1.8V typical (1.62V-1.98V).
84	P2.11/NFC_P	J1	P2.11/NFC_P	For NFC or GPIO
85	P2.02	G2	P2.02	
86	P2.00	F3	P2.00	
87	P2.10/NFC_N	H1	P2.10/NFC_N	For NFC or GPIO
88	P2.01	G3	P2.01	
89	GND		VSS	–
90	GND		VSS	
91	GND		VSS	–
92	GND		VSS	–
93	GND		VSS	–
94	GND		VSS	–
95	GND		VSS	–
96	GND		VSS	–
97	GND			Extra GND for chip antenna
98	GND			Extra GND for chip antenna
99	GND			Extra GND for chip antenna
100	GND			Extra GND for chip antenna
101	GND			Extra GND for chip antenna

102	GND			Extra GND for chip antenna
103	GND			Extra GND for chip antenna
104	VDD_1V8			For Normal voltage mode connect external supply of 1.8V only to BOTH pin104(VDD_1V8) and pin77(VDD_HV).

Pin #	Pin Name	nRF54H20 WLCSP Pin	nRF54H20 WLCSP Name	Comment	If Not Used
G1	GND			GND for the nRF54H20 GND paddle	
G2	GND			GND for the nRF54H20 GND paddle	
G3	GND			GND for the nRF54H20 GND paddle	
G4	GND			GND for the nRF54H20 GND paddle	

Pin Definition Notes:

	Note 1 GPIO	**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 drive 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.**			
	Note 2 SPI/TWI/Trace	TBD			
	Note 3 USB	**If using the USB interface,** then the BL54H20 VBUS pin (pin15) must be connected to external supply within the range 4.4V to 5.5V and MUST externally fit a 10uF to ground.			
Note 4 SWDIO / SWCLK / nRESET / VDD / GND		**Customer MUST bring out SWDIO, SWCLK, nRESET, VDD, GND for programming purposes.**			

GPIO ports information	GPIO ports per port number GOIO pins, pad type and description			
	Port **pins**	**Available**	**Pad type**	**Description number**
	P0	11:0	1V8 – Slow	Always-on port
	P1	11:0	1V8 – Slow	Analog peripherals
	P2	11:0	1V8 – Slow	Slow peripherals
	P6 erals P7	13:0 7:0	1V8 – Fast 1V8 – Fast	EXMIF and Fast periph Fast peripherals
	P9	5:0	3V3 – Slow	Analog peripherals

Electrical Specifications

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
Supply Voltages			
VDD_HV pin	-0.3	+5.8	V
VDD pin	-0.3	+2	V
VBUS	-0.3	+5.8	V
VDDIO_P1	-0.3	+2	V
VDDIO_P2	-0.3	+2	V
VDDIO_P6	-0.3	+2	V
VDDIO_P7	-0.3	+2	V
VDDIO_P9	-0.3	+3.9	V
Voltage at GND pin	-0.3	0	V
I/O pin voltage			
Voltage at GPIO pin (at VDD≤3.6V)	-0.3	VDD +0.3	V
Voltage at GPIO pin (at VDD≥3.6V)	-0.3	+3.9	V
NFC antenna pin current (NFC1/2)	–	TBD	mA
Radio RF input level	–	TBD	dBm
Environmental			

Parameter	Min	Max	Unit
Storage temperature	-40	+105	ºC
MSL (Moisture Sensitivity Level)	–	4	–
ESD (as per EN301-489) Conductive Air Coupling		4 8	kV kV
Flash Memory (Endurance)	–	TBD	Write/erase cycles
Flash Memory (Retention)	–	TBD	–

Note 1	Wear levelling can be implemented by customer.

Recommended Operating Parameters

Table 3: Power supply operating parameters

Parameter	Min	Typ	Max	Unit
VDD_HV (independent of DCDC) supply range	1.9	3.0	5.5	V
VDD supply voltage		1.8		V
VBUS USB supply range	4.4	5	5.5	V
VDDIO_P1 External supply for GPIO port P1	1.62	1.8	1.98	V
VDDIO_P2 External supply for GPIO port P2	1.62	1.8	1.98	V
VDDIO_P6 External supply for GPIO port P6	1.62	1.8	1.98	V
VDDIO_P7 External supply for GPIO port P7	1.62	1.8	1.98	V
VDDIO_P9 External supply for 3V GPIO port P9	1.62	3.3	3.6	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 VDD supply rise time (0V to 1.7V)[2] >10mS	– –	TBD TBD	TBD TBD	mS mS
Operating Temperature Range	-40	+25	+105	ºC

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	BL54H20 power supply options: · **Option 1 High Voltage Mode** – Connect external supply voltage (within range 1.9V-5.5V) to VDDH pin. Customer MUST externally fit a 10uF (0603 body size) to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized so the Effective Specification for this 10uF capacitor is 3uF to 12uF over all conditions (DCbias=5.5V, ACbias=0.01V and temperature range -40°C to +105°C). · **Option 2 Normal Voltage Mode** – Connect external supply voltage (within range 1.8V) to both VDDH and VDD pin. If using USB interface then the BL54H20 VBUS pin must be connected to external supply within the range 4.4V to 5.5V. When using the BL54H20 VBUS pin, customer MUST externally fit a 10uF (0603 body size) to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized so the Effective Specification for this 10uF capacitor is 3uF to 12uF over all conditions (DCbias=5.5V, ACbias=0.01V and temperature range -40°C to +105°C).
Note 4	VDDH/VDD (either High voltage mode or Normal voltage mode) must be powered before VDDIO_Px.

Clocks

HFXO – 32MHz crystal oscillator and nRF54H20 internal load capacitor TBDpF mandatory setting

The BL54H20 module contains the 32 MHz crystal, but the load capacitors to create 32MHz crystal oscillator circuit are inside the nRF54H20 chipset. Customer MUST set the internal nRF54H20 capacitors to TBDpF (for proper operation of the 32 MHz crystal circuit).
The 32 MHz crystal inside the BL54H20 module is a high accuracy crystal (±15 ppm at room temperature) that helps with radio operation and reducing power consumption in the active modes.

LFCLK – Low Frequency clock source

There are four possibilities (see figure 5) for the low frequency clock (LFCLK) and the options are:
LFRC (32.768kHz RC oscillator): The Internal 32.768 kHz RC oscillator (LFRC) is fully embedded in nRF54H20 (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).
LFXO (32.768kHz crystal oscillator): For higher LFCLK accuracy (greater than ±250ppm 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 crustal terminal and ground. Optionally internal (to nRF54H20) capacitor of maximum TBDpF in TBDpF steps are provided on pins XL1 and XL2.
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:
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 generated from the HFXO.

Using the LFSYNT clock removes the requirement for an external 32.768kHz crystal but the increases the average power consumption as the HFCLK will turned on in the system.
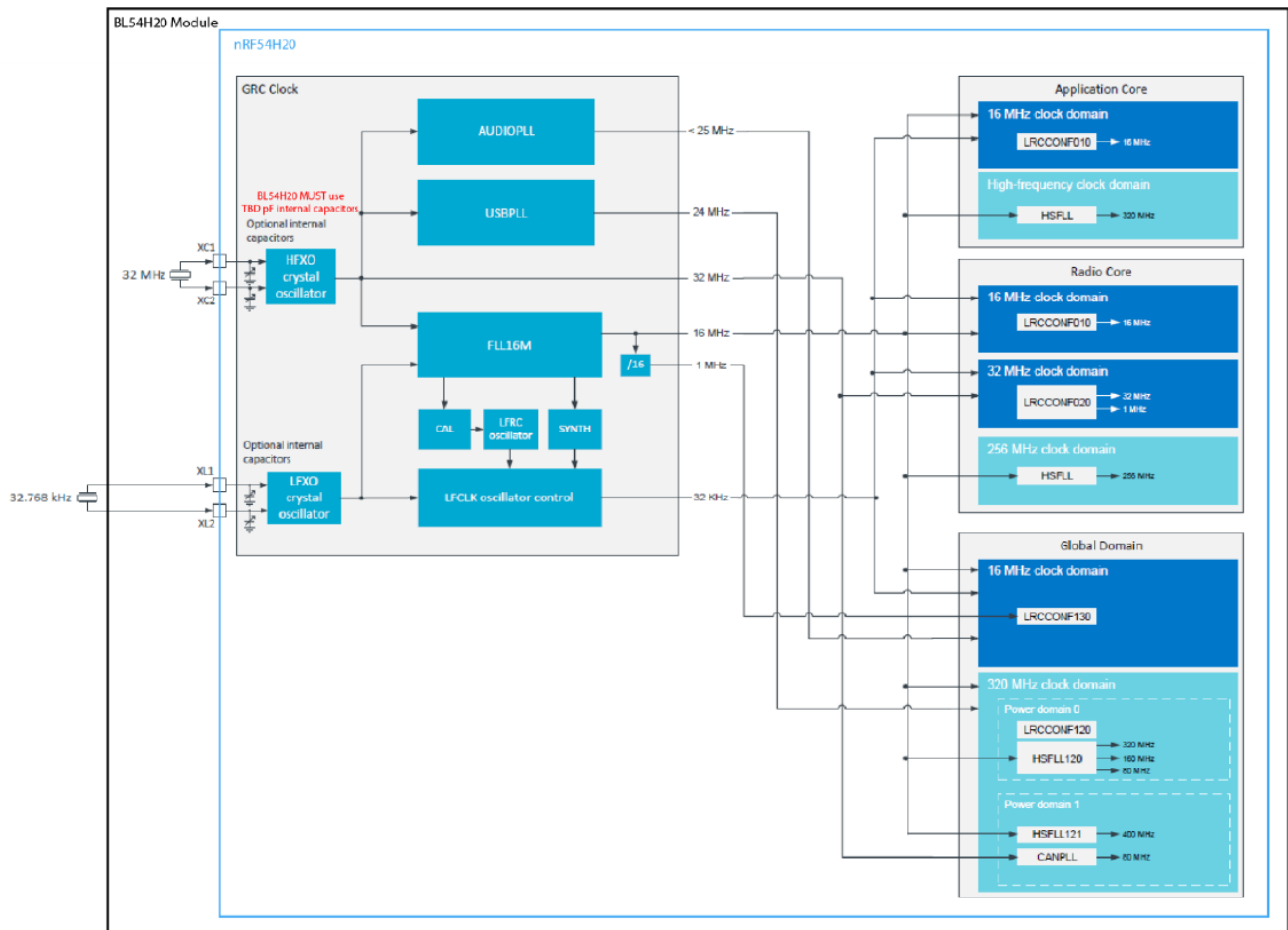
Other Internal Clocks

Figure 3: nRF54H20 Clock System Overview (adapted from Nordic)

BL54H20 Power Supply Options

The BL54H20 module power supply internally contains the following two main supply regulator stages (Figure 4):

- VDD_HV pin
- VDD pin

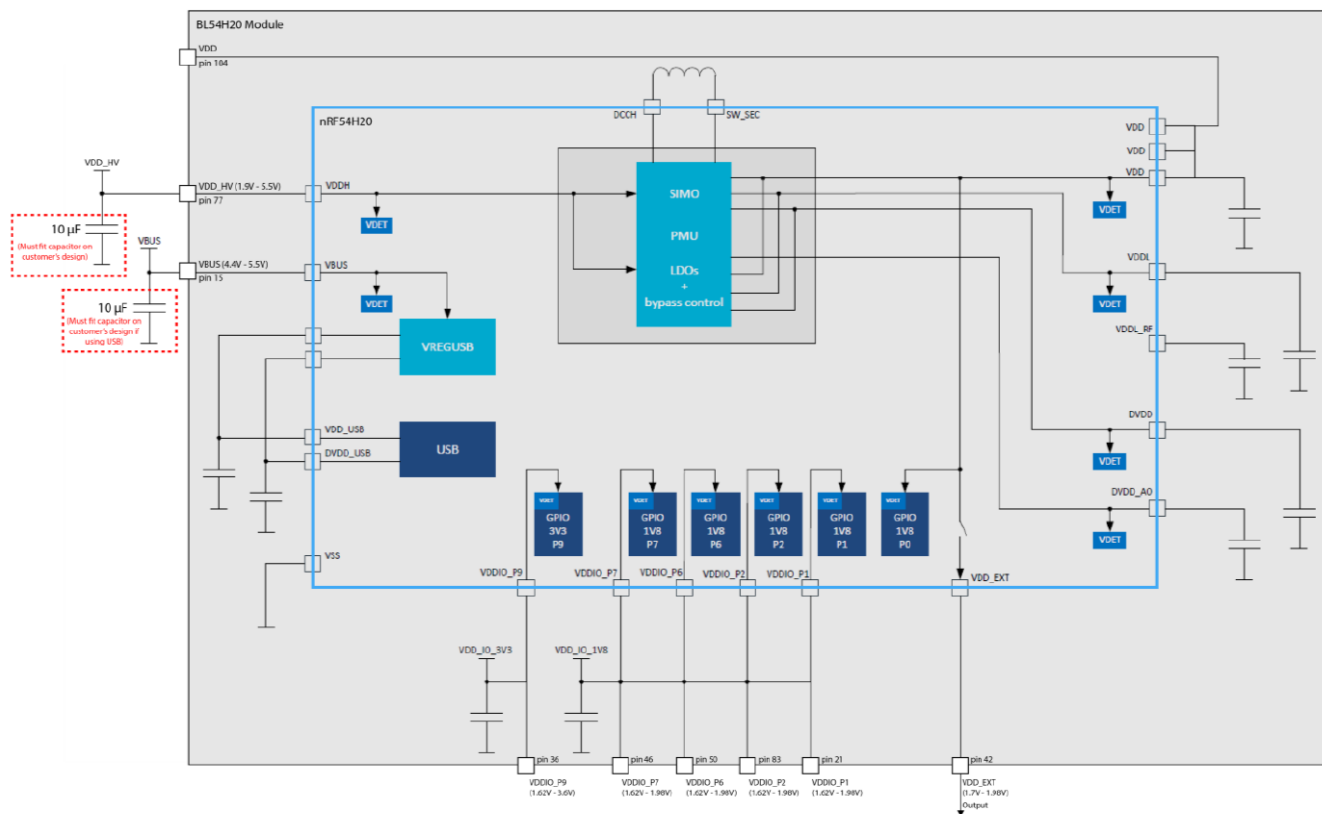The USB peripheral is powered separately (connected to the VBUS pin).

Figure 4: BL54H20 power supply block diagram (adapted from Nordic)

High Voltage mode (option1) or Normal Voltage mode (option2)

The BL54H20 power supply system enters one of two supply voltage modes, High voltage mode or Normal voltage mode, depending on how the external supply voltage is connected to these pins.

BL54H20 power supply options:

Option 1 High Voltage Mode – Connect external supply voltage (within range 1.9V-5.5V) to VDDH pin. Customer MUST externally fit a 10uF (0603 body size) to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized so the Effective Specification for this 10uF capacitor is 3uF to 12uF over all conditions (DCbias=5.5V, ACbias=0.01V and temperature range -40°C to +105°C).

OR

Option 2 Normal Voltage Mode – Connect external supply voltage (1.8V) to both VDDH and VDD pin.

For either option, If using USB interface then the BL54H20 VBUS pin must be connected to external supply within the range 4.4V to 5.5V. When using the BL54H20 VBUS pin, customer MUST externally fit a 10uF (0603 body size) to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized so the Effective Specification for this 10uF capacitor is 3uF to 12uF over all conditions (DCbias=5.5V, ACbias=0.01V and temperature range -40°C to +105°C).

Figure 5: High Voltage mode (option1)

Figure 6: Normal Voltage Mode (option2)

VBUS pin and 10uF Mandatory Capacitor

To use the BL54H20 USB peripheral:

1. Connect the BL54H20 VBUS pin to the external supply within the range 4.4V to 5.5V. When using the BL54H20 VBUS pin, you MUST externally fit a 10uF (0603 body size) to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized (the Effective Specification for this 10uF capacitor is 3uF to 12uF over all conditions DCbias=5.5V, ACbias=0.01V and temperature range -40°C to +105°C).
2. When using the BL54H20 USB peripheral, the VBUS pin can be supplied from same source as VDD_HV (within the operating voltage range of the VBUS pin and VDD_HV pin).
3. An optional series 2.2Ohms 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.

Programmability

BL54H20 Default Firmware

The BL54H20 module is shipped from Ezurio manufacturing facilities with no firmware programmed.

BL54H20 Firmware Options

Firmware for use with the BL54H20 can be divided into the following types.

- Bootloader – This is the application that resides on the Application core used for perform firmware updates on the Application, Radio, FLPR and PPR cores.
  The MCU Boot or Trusted Firmware M Bootloaders are recommended to be used as the basis for the BL54H20 Bootloader functionality.
- Application – This is the main application code that resides on the Application core. It interfaces with the Radio core and PPR/FLPR cores and provides supplementary functionality to that of the time critical activities being performed on the Radio, PPR and FLPR cores.
- Radio Stack – This is the protocol stack(s) that reside on the Radio Core. These control the radio and perform time critical radio operations, the results of which are provided to the Application core for high level processing.
- Software-Defined Peripheral – These are the applications running on the FLPR and PPR RISC-V cores intended to offload activities from the Application core.
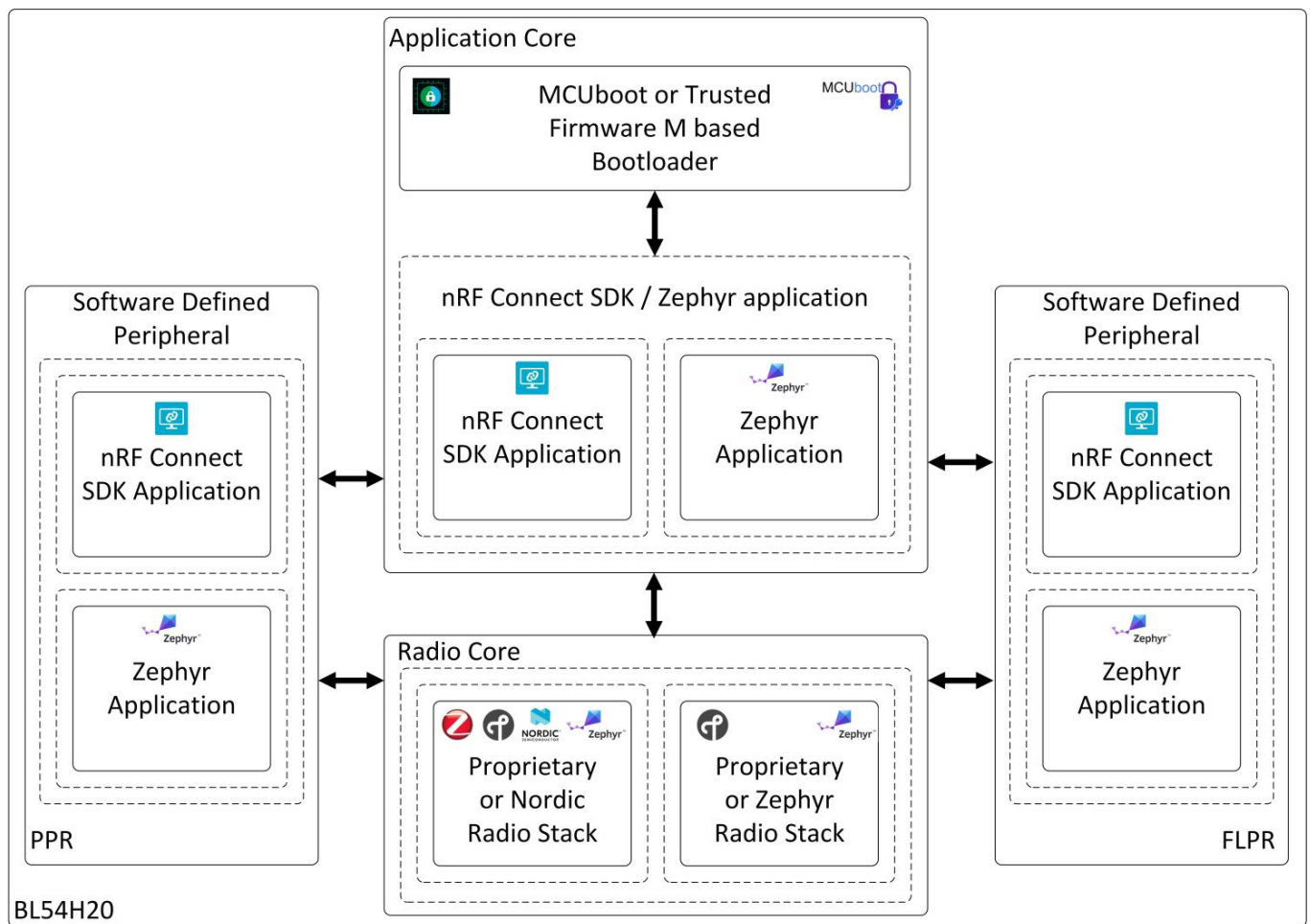
Figure 7: Functional SW block diagram for BL54H20 series module

Mandatory SW requirements related to hardware

32MHz crystal internal load capacitor setting of TBD pF

MANDATORY. BL54H20 module contains the 32 MHz crystal but the load capacitors to create 32 MHz crystal oscillator circuit are inside the nRF54H20 chipset. Customer MUST set the internal nRF54H20 capacitors to TBD pF (for proper operation of the 32 MHz crystal circuit in the BL54H20 module).

Hardware Integration Suggestions

Circuit

The BL54H20 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):

- BL54H20 power supply options:

  Option1 High Voltage Mode – Main voltage input (using BL54H20 VDD_HV pin) the external supply voltage (within range 1.9V-5.5V) is ONLY connected to the VDD_HV pin.

  Option 2 Normal Voltage Mode – Connect external supply voltage (within range 1.8V) to both VDD_HV and VDD pin.

- BL54H20 GPIO ports power:

VDDIO_P1, VDDIO_P2, VDDIO_P6, VDDIO_7 GPIO power supply pins: Connect external supply (within range 1.62V to 1.98V range) to power BL54H20 GPIO these GPIO ports P1, P2, P6, P7 ports power pins

VDDIO_P9 GPIO power supply pins: Connect external supply (within range 1.62V to 3.6V range) to power BL54H20 GPIO 3V port power pin VDDIO_P9. External power source should be within the operating range, rise time and noise/ripple specification of the BL54H20. Add decoupling capacitors for filtering the external source. Power-on reset circuitry within BL54H20 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.

- BL54H20 USB peripheral: To use the BL54H20 USB peripheral:

1. Connect the BL54H20 VBUS pin to the external supply within the range 4.4V to 5.5V. When using the BL54H20 VBUS pin, you MUST externally fit a 10uF to ground. Ensure capacitor value reduction due to DC bias, AC bias, temperature is minimized so the Effective Specification for this 10uF capacitor is 3uF to 12uF over all conditions (DCbias=5.5V, ACbias=0.01V and temperature range -40°C to +105°C).
2. Connect the external supply to VDD_HV pin to operate the rest of BL54H20 module.
3. When using the BL54H20 USB peripheral, the VBUS pin can be supplied from same source as VDD_HV (within the operating voltage range of the VBUS pin and VDD_HV pin).
4. An optional series 2.2Ohms 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 BL54H20 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. 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. nRF54H20 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.
- EXMIF, QSPI, High Speed SPI (32Mbps), High speed TWI (I2C, 1Mbps), QSPI and Trace EXMIF, QSPI, High-Speed SPI (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 Ezurio flexi-PCB NFC antenna (part # 0600-00061), 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 nRF54H20).
- 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 nRF54H20 or discrete capacitors outside nRF55) whose values should be tuned to meet all specification for frequency and oscillation margin.

PCB Layout on Host PCB – General

Checklist (for PCB):

- MUST locate BL54H20 module close to the edge of PCB (mandatory for the 453-00197 for on-board chip antenna to radiate properly).
- Use solid GND plane on the 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 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, VDD_HV, 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 BL54H20 development board).

PCB Layout on Host PCB for the 453-0019x

Antenna Keep-out on Host PCB

The 453-00197 has an integrated chip antenna (Ignion NN02-101) and its performance is sensitive to host PCB. It is critical to locate the 453-00197 on the edge of the host PCB (or corner) to allow the antenna to radiate properly. Refer to guidelines in section PCB land pattern and antenna keep-out area for the 453-00197. 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 453-00197 module on the edge of the host PCB, preferably in the edge center.

- The BL54H20 development board (453-00197-K1) has the 453-00197 module on the edge of the board (not in the corner). The antenna keep-out area is defined by the BL54H20 development board which was used for module development and antenna performance evaluation is shown in Figure 8, where the antenna keep-out area is 5mm wide, 5mm long; with PCB dielectric (no copper) height 1.6mm sitting under the 453-00197 chip antenna. There is an extra copper cutout of 3.631mm x 1.046mm under 453-00197 chip antenna RF matching circuit.
- The 453-00197 chip antenna is tuned when the 453-00197 is sitting on the development board (host PCB) with size of 141.6mm x 63.5mm x 1.6mm.
- A different host PCB thickness dielectric will have small effect on antenna.
- The antenna-keep-out defined in the 7.2 Host PCB Land Pattern and Antenna Keep-out for the 453-00197 section.
- Host PCB land pattern and antenna keep-out for the BL54H20 applies when the 453-00197 is placed in the edge of the host PCB preferably in the edge center. Figure 8 shows an example.
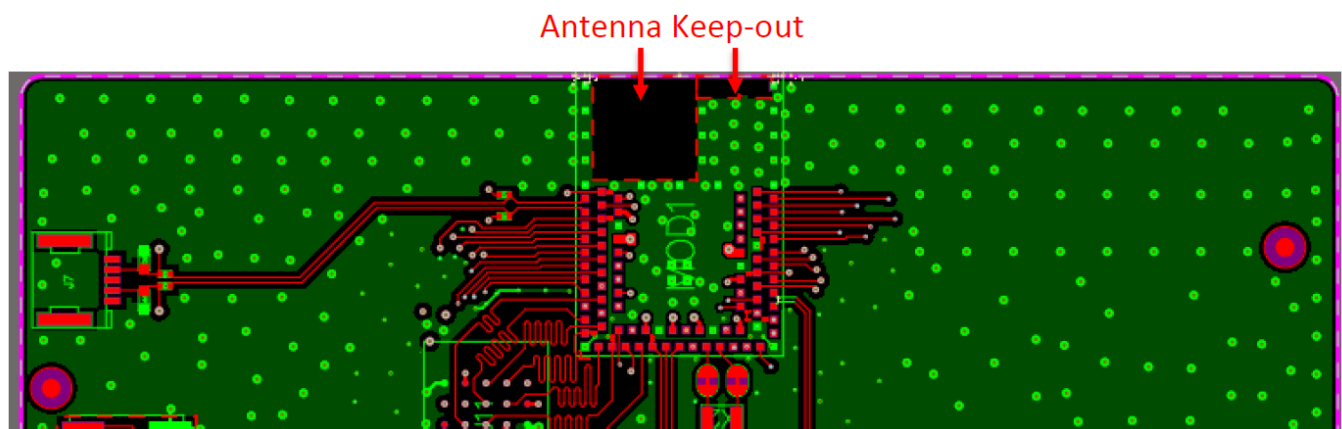

Figure 8: Chip Antenna keep-out area (shown in red), corner of the BL54H20 development board for the 453-00197 module.

Antenna Keep-out Notes:	
Note 1	The BL54H20 module is placed on the edge, preferably edge centre of the host PCB.
Note 2	Copper cut-away on all layers in the *Antenna Keep-out* area under the 453-00197 on host PCB.

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 453-00197 chip 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).

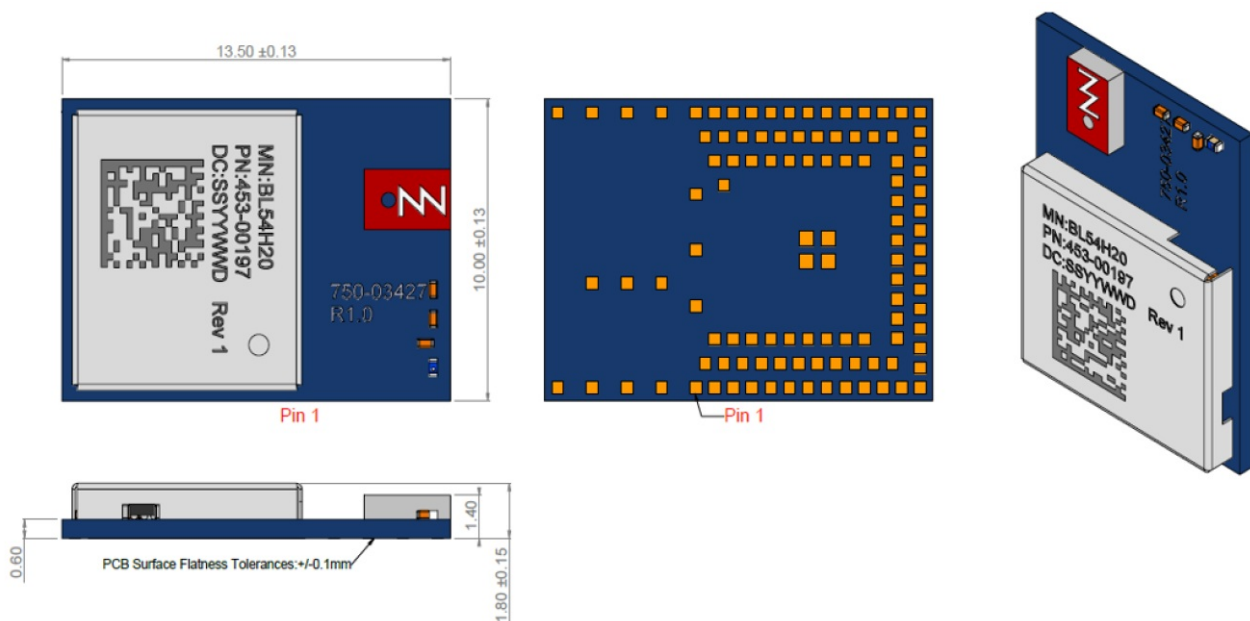**External Antenna Integration with BL54H20 MHF4 variant (453-00198)**

Please refer to the regulatory sections for FCC, ISED, CE, MIC, UKCA and RCM details of use of BL54H20 with external antennas in each regulatory region. The BL54LH20 family has been designed to operate with the below external antennas (with a maximum gain of 2.32 dBi). The required antenna impedance is 50 ohms. See Table 4. External antennas improve radiation efficiency.

Table 4: External antennas for the BL54H20 MHF4 variant module (453-00198)

Manufacturer	Model	Ezurio Part Number	Type	Connector	Peak Gain	
					2400-2500 MHz	2400-2480 MHz
Ezurio	NanoBlue	EBL2400A1-10MH4L	PCB Dipole	IPEX MHF4	2 dBi	–
Ezurio	FlexPIFA	001-0022	FlexPIFA	IPEX MHF4L	–	2 dBi
Mag.Layers	EDA-8709-2G4C1-B27-CY	0600-00057	Dipole	IPEX MHF4	2.32 dBi	–
Ezurio	mFlexPIFA	EFA2400A3S-10MH4L	FlexPIFA	IPEX MHF4L	–	2 dBi
Ezurio	iFlexPIFA Mini	EFG2401A3S-10MH4L	i-FlexPIFA	IPEX MHF4L	–	2 dBi
Ezurio	Ezurio NFC	0600-00061	Coiled Inductor	FFC/FPC Connector	–	–

Mechanical Details

BL54H20 Mechanical Details

Figure 9: Mechanical Details – Internal Antenna variant

Figure 10: Mechanical Details – MHF4 RF connector variant

3D models for BL54H20 Module, Chip Antenna (453-00197) and BL54H20 Module, MHF4 (453-00198) can be found on the BL54H20 product page
https://www.ezurio.com/product/bl54h20-series-multi-core-bluetooth-le-80215-4-nfc

Host PCB Land Pattern and Antenna Keep-out for the 453-00197

PCB footprint – BL54H20, Chip ANT (DXF and Altium format) and SCH Symbol – BL54H20, Chip ANT (Altium format) can be found on the BL54H20 product page –
https://www.ezurio.com/product/bl54h20-series-multi-core-bluetooth-le-80215-4-nfc

All dimensions are in mm.

Figure 11: Land pattern 453-00xxxand Keep-out for the 453-00197

Host PCB Land Pattern and Antenna Keep-out for the 453-000xx 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 **6.3.2)** to reduce effects of proximity detuning the antenna and to help antenna radiate properly.
Note 2	For the best on-board chip antenna performance, the module 453-00197 MUST be placed on the edge of the host PCB and preferably in the edge centre and host PCB (see **Note 4**).
Note 3	BL54H20 development board has the 453-00197 placed on the edge of the PCB board (and not in corner), see section **7.2 Host PCB Land Pattern and Antenna Keep-out for the 453-00197.**
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.

Chip Antenna Performance

Summary of Antenna Performance

Note : The result is measured with 453-00197-K1

	2402MHz	2440MHz	2480MHz
Peak Antenna Gain dBi	1.53dBi	2.22dBi	2.11dBi
Average Antenna Gain dBi	-0.14dBi	0.49dBi	0.36dBi

2.4GHz Radiated Performance
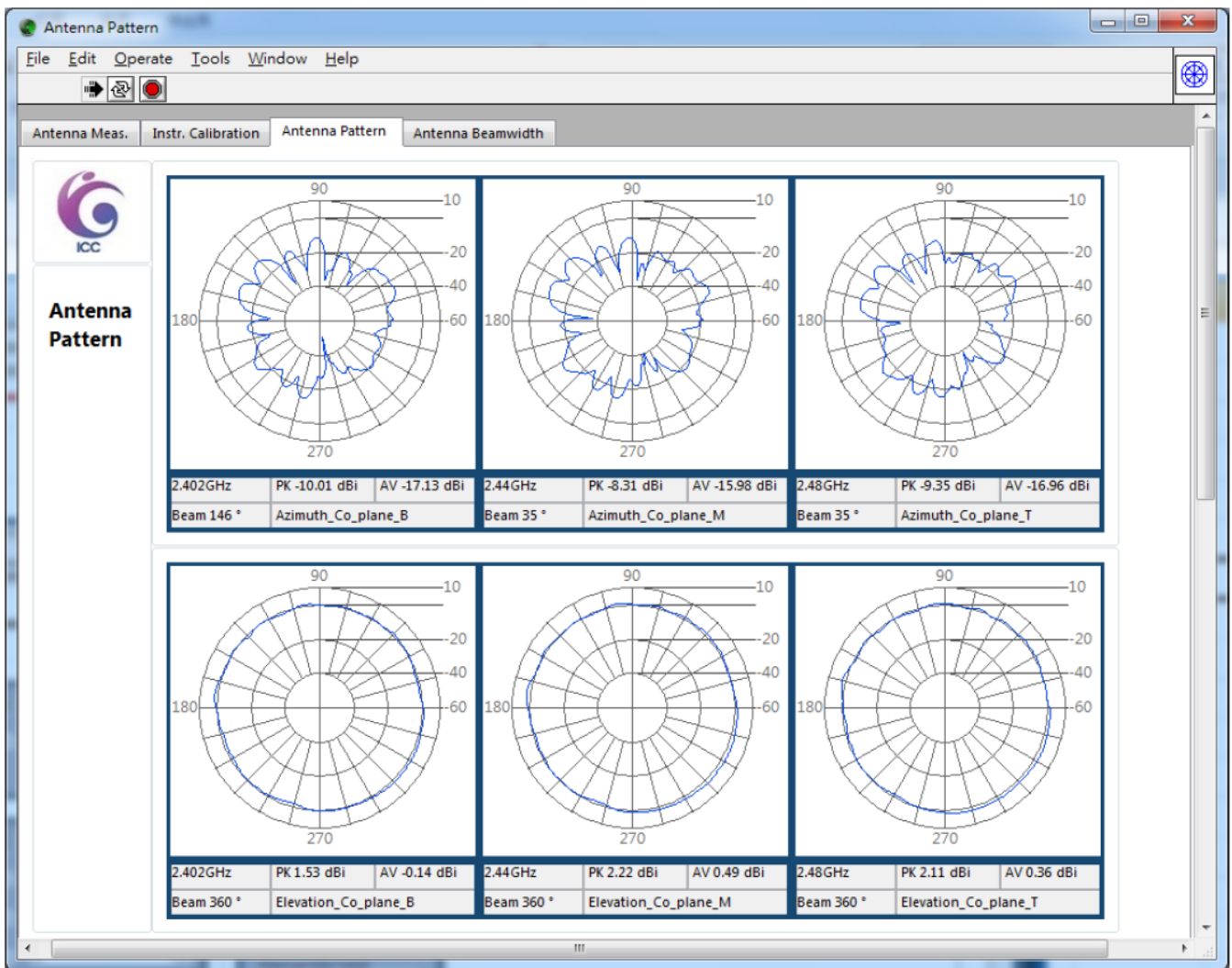
Antenna S11 measuring data

| Trc1 | S11 | dB Mag | 10 dB/ Ref 0 dB | Cal | Trc2 | S21 | dB Mag | 5 dB/ Ref -11 dB | Cal | 1 ∨ |
| Trc3 | S22 | dB Mag | 5 dB/ Ref -10.85 dB | Cal |

-850mdB

0 dB

-10.85 dB

-15.9dB

-20.9dB

-25.9dB

-30.9dB

-35.9dB

-40.9dB

-45.9dB

-50.9dB

M1	2.402000 GHz	-8.9457 dB
M2	2.412000 GHz	-10.4152 dB
M3	2.437000 GHz	-16.3925 dB
M4	2.442000 GHz	-17.6138 dB
M5	2.462000 GHz	-16.3960 dB
M6	2.472000 GHz	-13.6182 dB
M7	2.480000 GHz	-11.7751 dB
M1	2.402000 GHz	-76.4025 dB
M2	2.412000 GHz	-73.4512 dB
M3	2.437000 GHz	-69.3003 dB
M4	2.442000 GHz	-72.6805 dB
M5	2.462000 GHz	-76.4401 dB
M6	2.472000 GHz	-69.9417 dB
M7	2.559000 GHz	-84.4121 dB
M1	2.402000 GHz	-0.0113 dB
M2	2.412000 GHz	-0.0152 dB
M3	2.437000 GHz	-0.0145 dB
M4	2.442000 GHz	-0.0187 dB
M5	2.462000 GHz	-0.0149 dB
M6	2.472000 GHz	-0.0125 dB
• M7	2.559000 GHz	-0.0083 dB

Ch1 Start 2 GHz   Pwr -10 dBm Bw 10 kHz UOSM P1,P2   Stop 3 GHz

Ordering Information

Part Number	Product Description
453-00197R	Module, BL54H20 (Nordic nRF54H20), Chip antenna, Tape/Reel
453-00198R	Module, BL54H20 (Nordic nRF54H20), MHF4 Connector, Tape/Reel
453-00197C	Module, BL54H20 (Nordic nRF54H20), Chip antenna, Cut Tape
453-00198C	Module, BL54H20 (Nordic nRF54H20), MHF4 Connector, Cut Tape
453-00197-K1	Development kit, Module BL54H20 (Nordic nRF54H20), Chip antenna
453-00198-K1	Development kit, Module BL54H20 (Nordic nRF54H20) – MHF4 Connector

FCC Statement

Regulatory

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.

IMPORTANT NOTE:

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

Integration instructions for host product manufacturers

Applicable FCC rules to module

FCC Part 15.247

Summarize the specific operational use conditions

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

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.

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

"FCC 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." Antennas

Manufacture / Part Number	Type	Connector	Gain(dBi)
Ezurio / EBL2400A1-10MH4L	PCB Dipole	IPEX MHF4	2
Ezurio / 001-0022	FlexPIFA	IPEX MHF4L	2
Mag.Layers / 0600-00057	Dipole	IPEX MHF4	2.32
Ezurio / EFA2400A3S-10MH4L	FlexPIFA	IPEX MHF4L	2
Ezurio / EFG2401A3S-10MH4L	i-FlexPIFA	IPEX MHF4L	2
Ezurio / 0600-00061 (NFC)	Coiled Inductor	FFC/FPC Connector	–
Ignion / NN02-101	Chip loop	NA	2.4

Label and Compliance Information

- Product manufacturers need to provide a physical or e-label stating "Contains FCC ID: SQG-BL54H20" with finished product
- Information on Test Modes and Additional Testing Requirements
- Test tool: PuTTY, Version:0.60 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

Industry Canada statement:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference
2. This device must accept any interference, including interference that may cause undesired operation of the device

Radiation Exposure Statement:

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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

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.

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 IMPORTANT:

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains IC:3147A-BL54H20". Plaque signalétique du produit final

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

This radio transmitter [IC: 3147A-BL54H20 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.

Manufacture / Part Number	Type	Connector	Gain(dBi)
Ezurio / EBL2400A1-10MH4L	PCB Dipole	IPEX MHF4	2
Ezurio / 001-0022	FlexPIFA	IPEX MHF4L	2
Mag.Layers / 0600-00057	Dipole	IPEX MHF4	2.32
Ezurio / EFA2400A3S-10MH4L	FlexPIFA	IPEX MHF4L	2
Ezurio / EFG2401A3S-10MH4L	i-FlexPIFA	IPEX MHF4L	2
Ezurio / 0600-00061 (NFC)	Coiled Inductor	FFC/FPC Connector	–
Ignion / NN02-101	Chip loop	NA	2.4

Europe – EU Declaration of Conformity

This device complies with the essential requirements of the Radio Equipment directive: 2014 / 53 / EU. The following test methods have been applied in order to prove presumption of conformity with the essential requirements of the Radio Equipment directive: 2014 / 53 / EU:

- EN 300 328 V2.2.2
- (BS)EN 50385 2017
- (BS)EN 50665 2017
- (BS)EN 62311 2008
- EN 300 330 V2.1.1
- EN 301 489-1 V2.2.3
- EN 301 489-3 V2.3.2
- EN 301 489-17 V3.3.1
- IEC 62368-1:2018; ; and/or
- (BS) EN IEC 62368-1:2020+A11:2020
- 2400-2483.5GHz: 9.98dbm
- BT LE: 9.96dbm
- SW version: v0.5.1
- RF exposure statement
- The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20cm.

Additional Information

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

Headquarters	Ezurio 50 S. Main St. Suite 1100 Akron, OH 44308 USA
Website	**http://www.ezurio.com**
Technical Suppor t	**http://www.ezurio.com/resources/support**
Sales Contact	**http://www.ezurio.com/contact**

- **https://www.ezurio.com/**

Documents / Resources

Datasheet BL54H20 Series	**ezurio BL54H20 Series Multi Core Bluetooth LE 802.15.4 NFC Module** [pdf] Owner's Manual SQG-BL54H20, SQGBL54H20, bl54h20, BL54H20 Series Multi Core Bluetooth LE 802.15.4 NFC Module, BL54H20 Series, Multi Core Bluetooth LE 802.15.4 NFC Module, Bluetooth LE 802.15.4 NFC Module, LE 802.15.4 NFC Module, NFC Module, Module

References

- **User Manual**