Rayson technology Co., Ltd.

 BTM-NL15X(Nordic nRF54L15))/建錄2/用發工具概述

 Carbon technology Co., Ltd.

 Data technology



- (c). Rayson BTM-NL15X 模組開發板 (BTM-NL15X-DK)
- (d). Nordic 軟體開發套件安裝
  - nRF Command Line Tools
  - nRF Connect for Desktop
- B. <u>硬體環境架設準備</u>:
  - (a) Nordic NRF54L15-DK (PCA10156-nRF54L15) x 1
  - (b) Rayson BTM-NL15X-DK x 1
  - (c) IDC 排線 x 1
  - (d) Micro USB-C 連接線 x 2
- C. <u>硬體環境架設</u>:

請使用 Nordic nRF54L15DK/ nRF54L15PDK 作為燒錄器,搭配 Rayson 開發 板 BTM-NL15X-DK 作為開發工具,以進行 nRF54L15 的程式碼編譯與開發。

- 步驟 1: 透過 USB-C 連接線為 NRF54L15 DK 和 BTM-NL15X-DK 供 雷。
- 步驟 2:透過 IDC(SWD)排線連接 Nordic nRF54L15 DK 和 Rayson BTM-NL15X-DK •







雷松 BTM-NL15X-DK 開發板線路圖如下:

< BTM-NL15C Daughter board 線路圖 > 請聯絡業務 < BTM-NL15X DK 線路圖 > 請聯絡業務

## D. Nordic 軟體開發套件安裝

(a) nRF Command Line Tools 下載點: <u>Download nRF Command Line Tools</u> (Please Click Me)

- 選擇 Windows X86 64 - 10.24.2 版本: nrf-command-line-tools-10.24.2-x64.exe

 (b) nRF Connect for Desktop 下載點: <u>Download nRF Connect For Desktop</u> (Please Click Me)

- 選擇 Windows 64-bit - 5.1.0 版本: nrfconnect-setup-5.1.0-x64.exe

(c) Segger J-LINK driver 下載點: <u>Donnload Segger J-LINK driver</u> (Please Click Me)

提醒:安裝上述兩個程式時,可能會自動跳出 SEGGER J-LINK 需要一併 安裝,需安裝 v8.10f or newer。

## <u>Nordic 程式開發工具</u>:

nRF Connect SDK(NCS)支援免費的 VS (Visual Studio) Code IDE 做開發。 建議使用 NCS 2.8.0 (含)以上的版本來實現 nRF54L15 的功能應用。

● 步驟 1 : 開啟"nRF Connect for Desktop" → 選擇"Toolchain Manager" → 點擊"Open" 。



● 步驟 2: 會有數個 nRF Connect SDK vx.x.x 的版本如下圖;建議安裝 NCS v2.8.0(含)以後的版本。

在此範例,我們選擇使用 NCS v2.8.0 版本。

Toolchain Manager v1.5.3	
SDK ENVIRONMENTS SETTINGS ABOUT	
Since the nRF Connect SDK v2.0.0, the nRF Connect for VS Code extension is the recommended I Connect SDK Toolchain and working with the nRF Connect SDK. The extension also provides sup environment. Install the extension	DE for managing the nRF port for the command line
nRF Connect SDK v2.9.1	Install +
nRF Connect SDK v2.9.0	Install
nRF Connect SDK v2.8.0	Install
● 步驟 3: 在安裝 SDK 之前, 先確認程式想要安裝在哪-	一個路徑 (C:\ncs)。
🙆 Toolchain Manager v1.5.3	
SDK ENVIRONMENTS SETTINGS ABOUT	
Installation directory C:\ncs	
Hide pre-release versions Hide pre-release environments that are not installed Show only three newest minor versions Hide environments older than three minor versions. Hide pre-release versions when a corresponding release is official.	
● 步驟 4 : nRF Connect SDK v2.8.0 安裝完成後, 點選"	Open VS Code" 。

Toolchain Manager v1.5.3	
DK ENVIRONMENTS SETTINGS ABOUT	
Since the nRF Connect SDK v2.0.0, the nRF Connect for VS Code ext Connect SDK Toolchain and working with the nRF Connect SDK. The environment. Install the extension	ension is the recommended IDE for managing the nRF extension also provides support for the command line
nRF Connect SDK v2.9.1	Install ~
nRF Connect SDK v2.9.0	Install
- DE O	First store





 步驟 6:在編譯配置內選擇對應的 IC 開發板名稱並進行編譯 (nrf54l15dk/nrf54l15/cpuapp)。



<ul> <li>         ・ ・・・・・・・・・・・・・・・・・・・・・・・・・・・</li></ul>	> bluetooth > peripheral_uart > build > peripheral_uart > zephy
● 新端 ~       人       ①       ①       ④       ④       ①       1       排序 ~       ■         ● bc       ● edt.pickle       2025/3/24 上       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● bc       ● isr_tables_swild       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● bc       ● isr_tables_swild       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_wild       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_wild       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_wild       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_wild       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_generated       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_generated       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_generated       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_generated       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_generated       2025/3/24 上       2025/3/24 上       2025/3/24 上       2025/3/24 上         ● act, tables_generatet       ● act, tables, tables, tables, tables	
bc       SM       @2025/3/24 ±         bu       cisr_tables       2025/3/24 ±         bu       cisr_tables       2025/3/24 ±         bu       cisr_tables_swild       2025/3/24 ±         bu       cisr_tables_swild       2025/3/24 ±         cisr_tables_swild       2025/3/24 ±         cisr_tables_wild       2025/3/24 ±         cisr_tables_vild       2025/3/24 ±         cisr_tables_cephyr_pre0       2025/3/24 ±         cisr_tables_generated       2025/3/24 ±         cisr_tables	檢視 🗸 🔹
•       bu       © isr_tables       2025/3/24 ±         >       •       isr_tables_swild       2025/3/24 ±         >       •       isr_tables_wild       2025/3/24 ±         >       •       ibitszephyr.a       2025/3/24 ±         >       •       isr_tables_vend.dep       2025/3/24 ±         >       •       isr_tephyr.pre0       2025/3/24 ±         >       •       inker_zephyr.pre0       2025/3/24 ±         >       •       inker_zephyr.pre0.cmd.dep       2025/3/24 ±         >       •       isrtables_generated       2025/3/24 ±         >       •       izephyr.dts       2025/3/24 ±         >       izephyr.dts.pre       2025/3/24 ±       2025/3/24 ±         >       izephyr.elf       2025/3/24 ±       2025	· 并 09:29 PICKLE 標案 701 KB
>       -       -       isr_tables_swild       2025/3/24 ±         >       -       isr_tables_swild       2025/3/24 ±         >       -       ibizephyr.a       2025/3/24 ±         >       -       ibizephyr.a       2025/3/24 ±         >       -       ibizephyr.a       2025/3/24 ±         >       -       -       Sinker       2025/3/24 ±         >       -       Ibiker.cmd.dep       2025/3/24 ±         >       -       Ibiker_zephyr_pre0       2025/3/24 ±         >       -       Ibiker_zephyr_pre0.cmd.dep       2025/3/24 ±         >       -       Ibikker_zephyr_pre0.cmd.dep       2025/3/24 ±         >       -       Ibikker_zephyr_pre0.cmd.dep       2025/3/24 ±         >       -       Ibikker_zephyr.pre0.cmd.dep       2025/3/24 ±         >       -       Ibikker_zephyr.bin       2025/3/24 ±         >       -       zephyr.dts       2025/3/24 ±         >       -       zephyr.dts.pre       2025/3/24 ±         >       -       zephyr.elf       2025/3/24 ±         >       -       zephyr.elf       2025/3/24 ±	午 09:32 C 來源檔案 23 K8
>       C       Disr_tables_vtld       2025/3/24 ±         >       F       Dibzephyr.a       2025/3/24 ±         >       F       Dibzephyr.a       2025/3/24 ±         >       F       Dinker       2025/3/24 ±         >       F       Dinker.cmd.dep       2025/3/24 ±         S       Dinker_zephyr_pre0       2025/3/24 ±         >       Dinker_zephyr_pre0.cmd.dep       2025/3/24 ±         >       Dinker_zephyr.pre0.cmd.dep       2025/3/24 ±         >       Dinker_zephyr.dts       2025/3/24 ±         >       Dinker_zephyr.dts       2025/3/24 ±         >       Zephyr.dts.pre       2025/3/24 ±         >       Zephyr.elf       2025/3/24 ±         >       Zephyr.elf       2025/3/24 ±	午 09:32 LD 檀聚 1 KB
>       >       Iibzephyr.a       2025/3/24 ±         >       r       S linker       2025/3/24 ±         >       Iinker.cmd.dep       2025/3/24 ±         S linker_zephyr_pre0       2025/3/24 ±         >       Iinker_zephyr_pre0       2025/3/24 ±         >       Iinker_zephyr_pre0       2025/3/24 ±         >       Snippets_generated       2025/3/24 ±         >       snippets_generated       2025/3/24 ±         >       zephyr.bin       2025/3/24 ±         >       zephyr.dts       2025/3/24 ±         >       zephyr.dts.pre       2025/3/24 ±         >       zephyr.eff       2025/3/24 ±	午 09:32 LD 借案 1 KB
>       Image: Simple Sim	午 09:32 A 福麥 1,301 KB
Iniker.cmd.dep       2025/3/24 ±         Iniker_zephyr_pre0       2025/3/24 ±         Iniker_zephyr_pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr_pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr_pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr_pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr.pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr.dts.pre       2025/3/24 ±         Iniker_zephyr.pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr.pre0.cmd.dep       2025/3/24 ±         Iniker_zephyr.pre1.cmg       2025/3/24 ±         Iniker_zephyr.pre1.cmg       2025/3/24 ±	午 09:32 Windows 命令捂 14 KB
Image: Septyr_pre0       2025/3/24 ±         Image: Septyr_pre0.cmd.dep       2025/3/24 ±	午 09:32 DEP 檀廠 6 KB
> <ul> <li>linker_zephyr_pre0.cmd.dep</li> <li>2025/3/24 ±</li> <li>runners</li> <li>2025/3/24 ±</li> <li>snippets_generated</li> <li>2025/3/24 ±</li> <li>zephyr.bin</li> <li>2025/3/24 ±</li> <li>zephyr.dts</li> <li>2025/3/24 ±</li> <li>zephyr.dts.d</li> <li>2025/3/24 ±</li> <li>zephyr.dts.pre</li> <li>2025/3/24 ±</li> <li>zephyr.dts.pre</li> <li>2025/3/24 ±</li> <li>zephyr.elf</li> <li>2025/3/24 ±</li> <li>zephyr.elf</li> </ul>	午 09:31 Windows 命令指 14 KB
Image: second system       Image: second system       2025/3/24 ±	・午 09:31 DEP 備案 6 KB
Image: snippets_generated       2025/3/24 ±	午 09:30 Yaml 未源個素 1 KB
image: system in the system	午 09:29 CMake 來源檔案 4 KB
zephyr.dts         2025/3/24 ±           zephyr.dts.d         2025/3/24 ±           zephyr.dts.pre         2025/3/24 ±           sr         zephyr.dts.pre           sr         zephyr.elf           2025/3/24 ±         2025/3/24 ±	午 09:32 BIN 福聚 235 KB
Zephyr.dts.d         2025/3/24 ±           Zephyr.dts.pre         2025/3/24 ±           Srt         Zephyr.elf         2025/3/24 ±           System         Zephyr.elf         2025/3/24 ±	午 09:29 DTS 檔案 21 KB
>         z         2	午 09:29 D 福泰 2 KB
> sr 2025/3/24 ⊥ > sy 225/3/24 ⊥ 2025/3/24 ⊥	午 09:29 PRE 樹寨 29 KB
> sy 2025/3/24 ±	午 09:32 ELF 福聚 4,940 KB
	午 09:32 HEX 機案 660 KB
>rad zephyr.map 2025/3/24	午 09:32 MAP 檔案 1.625 KB
> 🧎 radi 🗋 zephyr.stat 2025/3/24 🗠	

步驟 8:在 ACTIONS 底下有編譯(Build)/除錯(Debug)/燒錄(Flash)可提供
 開發者做選擇。
 < 編譯 Build >

× F	File Edit Selection View Go $\cdots$ $\leftarrow$	→
Ŋ	NRF CONNECT ····	🗙 Welcome 🛛 🗙
Q	ම් Manage toolchains @ Manage SDKs	
وع	+ Open an existing application	
Q	Create a new application	Visual S
Ь	🔄 Create a new board	
<b>æ</b>		Editing evo
₽	<ul> <li>Peripheral_uart (1 configuration   2 conte</li> </ul>	J
	> 😡 build sysbuild	Start
୲	+ Add build configuration	C+ New File
ഷ്പ്പ		🖒 Open File
لللت	V PERIPHERAL_UART build	🔁 Open Folder
	nRF Connect SDK v2.8.0	S Connect to
	> 🔂 Source files	y connection.
	> 🚰 Config files	Recent
	> 🚰 Output files	Recent
		v2.9.0 C:\ncs
	✓ ACTIONS build	
	nRF Connect SDK Toolchain v2.9.0	
	📩 Build 🖸 ··	
	Det Build Flas Run west build for the active context Ner O Pristine Build	
	Run west buildpristine for the build	d configuration of the active context

<sup>&</sup>lt; 除錯 Debug >

×	File Ed	it Selecti	on View	Go	Run	Terminal	Help	$\leftarrow \rightarrow$	
Ch	NRF	CONNECT					🗙 Welco	ome	👌 🗛
	$\sim$ weld	OME							
Q	هٔ M	anage tool	chains						
	🔗 М	anage SDK	s						
وم	+ o	oen an exis	ting applic	ation					
0	🎢 Cr	eate a new	application	n					
	훕 Cr	eate a new	board						
æ		ICATIONS							
	~ 🖻	periphera	al_uart (1 co	onfigur	ation   2	conte			
	> 5	🛃 build sy	sbuild						
61		🕂 Add bui	ld configur	ation					
190									
പ്പും									
न्ता	∨ PERI	PHERAL_UAI	RT build						
	nRF	Connect SE	)K v2.8.0						
	> ₽	1 Source fil	es						
	>₽	- ] Config fil	es						
	> 🗜	] Output fi	les						
	✓ ACTI	ONS build				2			
	nRF	Connect SE	K Toolchai	n v2.9	.0				
	📩 Bu	ild							
	<mark>e</mark> ≻ De	ebug				<u>ن،</u>			_
	🕑 Fla	ish	Flash the s	electe	d build	and debug	it on a con	nected devi	ce
	錢 nF	RF Kconfig (	GUI						
	<u>000</u> M	emory repo	ort						

< 燒錄 Flash >



提醒:如果無法使用 VS(Visual Studio)Code IDE 燒錄則依照以下步驟執行

- (a) 進入這網址(<u>https://www.nordicsemi.com/Products/Development-tools/nRF-Util/Download#infotabs</u>) 下載 nrfutil.exe
- (b) 將 nrfutil.exe 檔案放到 C:\Program Files\Nordic Semiconductor\nrfcommand-line-tools\bin 資料夾裡
- (c) 然後執行以下命令安裝,就能順利使用 VSC 進行燒錄

C:\Program Files\Nordic	Semiconductor\nrf-command-line-tools\bin>nrfutil list
Found 0 installed commar	nd(s)
C:\Program Files\Nordic	Semiconductor\nrf-command-line-tools\bin>nrfutil install nrf5sdk-tools
[00:00:14] ####### 100% [	Install packages] Install packages
C:\Program Files\Nordic	Semiconductor\nrf-command-line-tools\bin>nrfutil install device
[00:00:10] ####### 100% [	Install packages] Install packages
C:\Program Files\Nordic Command Version device 2.8.5 nrf5sdk-tools 1.1.0 dfu keys pkg settings zigbee	Semiconductor\nrf-command-line-tools\bin>nrfutil list Description Manage and program devices nRF5 SDK tools that were available in nRF Util 6
Found 2 installed comman	nd(s)

## Programmer 燒錄工具

開發者可在此使用"Programmer"來進行.hex 檔燒錄及觀察 Flash 配置。 下面介紹燒錄步驟:

● 步驟 1 :開啟"nRF Connect for Desktop" → 選擇"Programmer" → 點 選"Open"。

🧟 r	nRF Connect fo	r Desktop v5.1.0			-		>
	APPS	SETTINGS	ABOUT				
	≇ Filter	Search			Update a	all apps	
	0	Programmer Tool for flash p official, v4.5.0	rogramming Nordic SoCs and SiF	<sup>b</sup> s	Open	•	

● 步驟 2 :點選"Select Device" 。

🚺 Pro	grammer v4.5.0						-		×
	SELECT DEVICE	$\mathbf{\Psi}$	PROGRAMMER	ABOUT					
FIL	ε	-	File memory la	rout		De	evice memory layout		0
•	Add file								
C	Reload files								
DE	Programmer v4.5.0         SELECT DEVICE         FILE         Add file         C         Reload files         Clear files         Clear files         Clear files         DEVICE         Erase all         Erase & write         Save as file         Reset         Write         Read		_						
1	Erase all								
	Save as file						1 L		
	Reset								
1	Write								
0	Read			Drag & drop HEX/ZIP files here			Connect a device to display memory content	S.	
J-L	INK SETTINGS								
Aut	o reset	0							
MC	UBOOT SETTINGS					-			
Ens	ble MCUboot		16:48:57.519 16:48:58.081 16:48:58.081 16:48:58.081 16:48:58.081 16:48:58.083 16:48:58.083 16:49:14.827	Using the bundled core version for nr Using nrf-device version: 2.6.4 Using nrf-device-lib version: 0.17.35 Using nrfjprog DLL version: 0.10.24.2 Using JLink version: ULink_V8.10f Your version of SEGGER J-Link (8.10f Getting serial port options from the p	futil device: 7,13.0 () is newer than the or versistent store for 00	ne this 105779	app was tested with (7.94i). The tested version is not 91038.pc-nrfconnect-programmer	required	l, and y
1000		10	The second second	merez					-

● 步驟 3 :點選"nRF54L15 DK"。



● 步驟 4 :點選"Add File" 。

Progra	ammer v4.5.0						-		×
54	nRF54L15 DK 001057791038	▲	PROGRAMME	R ABOUT					
FILE			File memory l	ayout		20	NRF54L15_xxAA_ENGB ()		0
0	Add file Reload files Clear files								
DEVIC	: E	_		_					
·	Erase all Erase & write Save as file						Device core is connected		
•	Reset						Memory layout is not available for nRF54L fam	ly	
C	Read			Drag & drop HEX/ZIP files he	re				
J-LIN	K SETTINGS								
Auto re Auto re	ead memory eset								
MCUB	OOT SETTINGS		-						
Enable	MCUboot		16:54:10.692 16:54:12.173 16:54:12.174 16:54:12.191 16:54:12.191 16:54:12.192	Loading core information for Applic Reading readback protection status Reading readback protection status Reading readback protection status Application core protection status	cation core comple s for Application co s for Application co s for Application co NRFDL_PROTECTI s for Application co	ted ore 0% ore 100% ON_STA ore com	% ATUS_NONE' ipleted		

● 步驟 5:選擇要燒錄的.hex 檔。

Select a HEX	( / ZIP file					
$\leftarrow \rightarrow  \lor$	↑ ■	« samples > bluetooth > peripheral_uart >	build > peripheral_uart	> zephyr >	~ C	搜尋 zephyr
組合管理 ▼	新増資料夾	2				
	🔨 📁 k	名稱 arivers	修改日期 2025/3/27 上十 10:27	類型 個 系 貞 科 火	大小	
	-	🔁 include	2025/3/27 上午 10:26	檔案資料夾		
	> 🚞	🚞 kconfig	2025/3/27 上午 10:27	檔案資料夾		
	> 📒	🔁 kernel	2025/3/27 上午 10:29	檔案資料夾		
	> 🚞	📒 lib	2025/3/27 上午 10:27	檔案資料夾		
	> 🚞	🔁 misc	2025/3/27 上午 10:27	檔案資料夾		
	~ 🚞	soc	2025/3/27 上午 10:27	檔案資料夾		
	>	🚞 subsys	2025/3/27 上午 10:27	檔案資料夾		
	>	C zephyr.hex	2025/3/27 上午 10:29	HEX 檔案	660 KB	
	檔案	名稱(N): zephyr.hex			~	HEX / ZIP fil 開啟(O)

● 步驟 6 :點選"Erase & write" 開始燒錄。

54 nRF54L15 DK A PROGRAMMER ABOUT			
FILE       File memory layout       INFS4LT5,xxAA_ENGB O         Add file       INFS4LT5,xxAA_ENGB O         O Reload files       INFS4LT5,xxAA_ENGB O         O Clear files       Interset in the second sec		0	
Enable MCUboot       111:3:55:057       Application core protection status for Application core completed         111:3:55:568       Beading readback protection status for Application core completed         111:14:10:725       File was last modified at 2025/3/27 上午10:29:55         111:14:10:842       Parse reemony regions for file			I
SHOW SIDE PANEL 🕜 CLEARLOG OPENLOG FILE AUTOSORCUL LOG	•	SHOW LOG	

Programmer v4.5.0						-	
54 nRF54L15 DK	PROGE	RAMMER	ABOUT				¢
FILE	File	memory layo	ut		NRF54L15_xxAA_ENGB ©		0
Add file				. 1			
C Reload files							
Clear files							
DEVICE							
♂ Erase all							
✓ Erase & write							9
H Save as file							
Reset							9
₽ Write							8
C Read							8
J-LINK SETTINOS Auto read memory Auto reset	•						
Englis MPRived	16:59:1	0.127 U	date files regions according to Application core	_			
	16:59:1 16:59:1 16:59:1 16:59:1 16:59:1 16:59:1 16:59:1	0.127 Pi 2.455 Ri 2.457 Ri 2.475 Ri 2.475 Ri 2.476 Aj 2.476 Ri	arse memory regions for file adding readback protection status for Application adding readback protection status for Application adding readback protection status of Application oplication core protection status NRFDL_PROTEC adding readback protection status for <u>Application</u>		% ATUS_NONE pleted		
SHOW SIDE PANEL	CLEAR		00.01		AITO		

● 步驟8:當LOG出現"completed"的字樣時,代表燒錄已經完成。

步驟7:在燒錄的過程中,紅圈部分會顯示斜線。

Programmer v4.5.0		- 🗆 X	1
54 nRF54L15 DK ▲	PROGRAMMER ABOUT	8	
FILE	File memory layout 😂 NRF5	54L15_xxAA_ENGB @	
Add file     Reload files			
Erase & write      Save as file		Device core is connected	
Reset      Write		Memory layout is not available for nRF54L family	
C Read			
Auto read memory  Auto reset			
MCUBOOT SETTINGS			
Enable MCUboot	11:15:55:598         Update files regions according to Application core           11:15:55:598         Pease memory regions for file           11:15:59:288         Reading readback protection status for Application core           11:15:59:288         Reading readback protection status for Application core 0%           11:15:59:347         Reading readback protection status for Application core 100%           11:15:59:347         Application core protection status NRFD_LPROTECTION_STATUS_NONE           11:15:59:348         Reading readback protection status for Application core completed		
SHOW SIDE PANEL	CLEARLOG OPENLOG FILE	AUTOSCROLL LOG 💽 SHOW LOG 💽	

## E. <u>nRF Connect APP</u>

燒錄完成後,可使用 Nordic nRF Connect 手機 APP 來確認是否有做廣播。



- nRF54L15 DK hardware
- <u>nRF Connect SDK Documentation</u>
- Nordic nRF54L Series