# 設定及驗證 Wi-Fi 6E 頻帶運作和用戶端連線

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```

透過 AP 9166 測試

## 簡介

本文說明如何完成 Wi-Fi 6E 頻帶設定,以及不同用戶端預期會出現的行為。

## 必要條件

## 需求

思科建議您瞭解以下主題:

- 思科無線 LAN 控制器 (WLC) 9800
- 支援 Wi-Fi 6E 的思科存取點 (AP)
- IEEE 標準 802.11ax
- 網路工具: Wireshark

## 採用元件

本文中的資訊係根據以下軟體和硬體版本:

- WLC 9800-CL 搭配 Cisco IOS® XE 17.9.3
- AP C9136、CW9162 和 CW9166
- Wi-Fi 6E 用戶端:
  - Lenovo X1 Carbon Gen11 搭載 Intel AX211 Wi-Fi 6 和 6E 介面卡,並搭配 22.200.2(1) 版驅動程式
  - ◎ Netgear A8000 Wi-Fi 6 和 6E 介面卡搭配驅動程式 v1(0.0.108)
  - 搭載 Android 13 的手機 Pixel 6a
  - 搭載 Android 13 的手機 Samsung S23
- Wireshark v4.0.6

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除(預設))的組態來啟動。如果您的網路運作中,請確保您瞭解任何指令可能造成的影響。

## 背景資訊

請務必瞭解, Wi-Fi 6E 並非全新標準, 而是原有標準的延伸。 Wi-Fi 6E是Wi-Fi 6 (802.11ax)無線標 準在6 GHz射頻頻帶的延伸。

Wi-Fi 6E 的基礎是最新一代 Wi-Fi 標準 Wi-Fi 6,只不過 Wi-Fi 6E 裝置和應用程式可以在 6-GHz 頻 帶中運作。

由於 6-GHz 是新的頻譜,且只接受 Wi-Fi 6E 裝置使用,因此不會出現會導致目前網路堵塞的任何 舊問題。

此頻帶在以下各方面的表現更優異:

容量:在美國,FCC 定義了可容納 1200 MHz 或 59 個新頻道的額外頻譜。新的 6-GHz 頻帶具有 14 個 80-MHz 頻道和 7 個 160-MHz 頻道。其他國家為 WiFi 6E 分配的頻譜量可能不盡相同。如需 WiFi 6E 採用國家與地區的最新資訊,請參閱<u>啟用 Wi-Fi 6 GHz 頻帶 (Wi-Fi 6E) 的國家與地區</u>。

● 可靠性:Wi-Fi 6E 為連線樹立了新的可靠性和可預測性標準,有效縮小無線和有線連線之間的 差距。6 GHz 不支援 Wi-Fi 1 (802.11b) 到 Wi-Fi 6 (802.11ax) 的裝置。

● 安全性:Wi-Fi 6E 網路強制使用 Wi-Fi Protected Access 3 (WPA3),比以往更嚴密保護網路。 而且只有 Wi-Fi 6 產品會在這類網路中使用,因此不會發生任何以前的舊問題。WPA3 為網路提供 新的身分驗證機制和加密演算法,且可修正 WPA2 遺漏的問題。此外也額外增添一層保護,可抵禦 取消驗證和解除關聯攻擊。



2.4、5 和 6 GHz WiFi 頻譜與頻道比較

如需 Wi-Fi 6E 的其他背景資訊,請參閱我們的 <u>Wi-Fi 6E:Wi-Fi 白皮書重要新篇章</u>。

Wi-Fi 6E 包含多項管理功能和變更。本文的「驗證」一節簡短說明了實際環境中,驗證功能獲得強 化之處。

Wi-Fi 6E 安全性

Wi-Fi 6E 採用 Wi-Fi Protected Access 3 (WPA3) 及 Opportunistic Wireless Encryption (OWE) 有效 提升網路安全,且不與開放網路及 WPA2 的安全性向下相容。

Wi-Fi 6E 認證現在強制使用 WPA3 和 Enhanced Open Security, 且 Wi-Fi 6E 也要求 AP 和用戶端 使用受保護的訊框管理 (PMF)。

設定 6 GHz SSID 時,必須符合以下幾項安全要求:

• 採用 OWE、SAE 或 802.1x-SHA256 的 WPA3 L2 安全防護

- 啟用受保護的訊框管理
- 不允許使用其他 L2 安全防護方法,亦即不接受混合模式

如需深入瞭解如何在 Cisco WLAN 實作 WPA3,包含用戶端安全相容對照表,請參閱 <u>WPA3 部署</u> <u>指南</u>。

## Cisco Catalyst Wi-Fi 6E AP



Wi-Fi 6E 存取點

## 設定

本節示範的是基本 WLAN 設定。下文會說明如何設定每項 Wi-Fi 6E 元素,以及如何驗證設定和預 期行為。

## 網路圖表



網路圖表

## 組態

本文中的初始 WLAN 基本安全設定為 WPA3+AES+SAE 搭配 H2E,如下所示:

## Edit WLAN

ayer2 Layer3	AAA	Policy lags		
O WPA + WPA2	O WRA2 + WRA3	• WPA3	O Static WEP	O None
MAC Filtering	o 🗸		,	
Lobby Admin Access	0	-		
WPA Parameters	WPA2 O	Fast T Statu	i i	Disabled •
GTK O	WPA3 D	Over	the DS	0
Transition O Disable		Rease	ociation Timeout *	29
AES(CCMP128) C GCMP128 C	ocMP256 OCMP25	- Auto X SA OVI BOX SH	Cey Mgmt E  0 4E  0 2.1x- A256	FT + SAE O FT + 802.1x O
PMF	Required	•	i Clogging Threshold*	1500
Association Comebaci	t Timer* 1		needer	*
SA Query Time*	200		(Econot	407
		PS	C Type	Unencrypted ·
		Pre	-Shared Key*	
		SA	Password Demont O	Hash to Element 0.5

88

請依照以下章節中的步驟操作,完成 WLAN 設定並推送至 AP:Cisco Catalyst 9800 系列無線控制器軟體設定指南 Cisco IOS® XE Cupertino 17.9.x 中的<u>如何設定 WLAN</u>。

WLAN 會對應到包含切換和身分驗證原則的本機切換原則設定檔,如下所示:

#### **Edit Policy Profile**

A Disabling a Policy or configuring it in 'Enabled' state, will result in loss of connectivity for clients associated with this Policy profile.

General Access Policies	QOS and AVC Mobility Adva	nced	
Name*	Policy4TiagoHome	WLAN Switching Policy	
Description	ProductionPolicy	Central Switching	DISABLED
Status	ENABLED	Central Authentication	DISABLED
Passive Client	DISABLED	Central DHCP	DISABLED
IP MAC Binding	ENABLED	Flex NAT/PAT	DISABLED

## 驗證

使用本節內容,確認您的組態是否正常運作。

根據適用情況,驗證區段會依用戶端類型區分新變更或新導入的功能及觀察結果。

每個功能都會有「設定」和「驗證」區段。

在這些測試和驗證中,處於監聽器模式的 AP 會執行無線擷取 (OTA)。

如需瞭解如何設定處於監聽器模式的 AP,請參閱以下文章:處於監聽器模式的 Catalyst 91xx AP。

## 信標變更

信標仍存在於 Wi-Fi 6E 上,且預設情況下每 100 毫秒會傳送一次,不過與 Wi-Fi 6 (2.4 GHz 或 5 GHz) 信標稍有不同。Wi-Fi 6 信標中包含 HT 和 VHT 資訊元素,但 Wi-Fi 6E 移除了這些元素,只 包含 HE 資訊元素。

×

## Legacy HT/VHT Information Element Removed



## Comparison of Wi-Fi 6 and Wi-FI 6E Beacon Frame



Wi-Fi 6 與 Wi-Fi 6E 信標訊框比較

### 驗證

## 以下是 OTA 的實際內容:



附註:DS 參數集為選填欄位,不一定包含於信標訊框中。

## 多重基本服務集識別碼 (BSSID)

多重 BSSID 是原本在 802.11v 中指定的功能,會在單一信標訊框中結合多筆 SSID 資訊,亦即並非 為每個 SSID 使用一個信標,而是傳送包含多個 BSSID 的單一信標。

這是 Wi-Fi 6E 強制要求的做法,主要目標是節省無線傳輸時間。

設定多重 BSSID 設定檔 (GUI)

步驟 1: 依序選擇「設定」>「標籤和設定檔」>「多重 BSSID」。

步驟 2:按一下「新增」。「新增多重 BSSID 設定檔」頁面會隨即顯示。

步驟 3: 輸入 BSSID 設定檔的名稱和描述。

步驟 4: 啟用以下 802.11ax 參數:

- 下行鏈路 OFDMA
- 上行鏈路 OFDMA
- 下行鏈路 MU-MIMO
- 上行鏈路 MU-MIMO
- 目標喚醒時間
- TWT 廣播支援

步驟 5: 按一下套用至裝置。

	Configuration * > Tags & Profiles * > Multi BSSID		Edit Multi BSSID Profile		×
G. Sharet Manu turns	+ Add X Delate		Name*	MBSSIDprof/e_test	
Dashboard	Multi BSSID Profile Name	T De	Description	Enter Description	
Monitoring	MBSSiDprofile_test	<	Downlink OFDMA	ENABLED	
Configuration	default-multi-basid-profile	Def	Uplink OFDMA	ENABLED	
Administration			Downlink MU-MIMO	ENABLED	
C Licensing			Uplink MU-MIMO	ENABLED	
			Target Waketime	ENABLED	
~			TWT Broadcast Support	ENABLED	

#### 設定多重 BSSID 設定檔 (CLI)

Device# configure terminal Device (config)# wireless profile multi-bssid multi-bssid-profile-name Device (config-wireless-multi-bssid-profile)# dot11ax downlink-mumimo

在 RF 設定檔中設定多重 BSSID (GUI)

- 步驟1:選擇「設定」>「標籤和設定檔」>「RF/無線電」。
- 步驟 2:在 RF 索引標籤中,按一下新增。「新增 RF 設定檔」頁面會隨即顯示。
- 步驟 3: 選擇 802.11ax 索引標籤。
- 步驟 4:在多重 BSSID 設定檔欄位中,從下拉式清單中選擇設定檔。
- 步驟 5:按一下套用至裝置。

O. Smith Manufacture	Config	uration -	> Tags & Profiles * > RF/Radio		Edit RF Profile		ж
C OBTONINGIO GENE	RF	Radio			General 802.11 RRM Advanced	802.11ax	
Dashboard	-				6 GHz Discovery Frames 🛈	None	
Monitoring ,		Add	X Delete			Broadcast Probe Response     FILS Discovery	
2		State	T RF Profile Name	T Band	Brandsent Braha Basenara (stand) (specifi		
S Configuration	0	0	default-rf-profile-6ghz	6 GHz	Broadcast Probe Response Interval (msec)*	20	
Administration	0	0	Low_Client_Density_rf_5gh	5 GHz	Multi BSSID Profile	MBSSIDprofile_test •	
Ý	0	0	High_Client_Density_rf_5gh	5 GHz	Spatial Davage		
C Licensing	0	0	Low_Client_Density_rf_24gh	2.4 GHz	Spauar Neuse		
C Troublachanting	0	0	High_Client_Density_rf_24gh	2.4 GHz	OBSS PD	DISABLED	
Re mousieshooting	D	0	Typical_Client_Density_rf_5gh	5 GHz			
	0	0	Typical_Client_Density_rf_24gh	2.4 GHz	Non-SHG OBSS PD Max Infeshold (dbm)*	-62	
	24	- 1	⊫ ∺ 10 <b>▼</b>		SRG OBSS PD	DISABLED	
Walk Me Through 3					SRG OBSS PD Min Threshold (dBm)*	-82	
					SRG OBSS PD Max Threshold (dBm)*	+62	

在 RF 設定檔中設定多重 BSSID (CLI)

Device# configure terminal Device(config)# ap dot11 6ghz rf-profile rf-profile-name Device(config-rf-profile)# dot11ax multi-bssid-profile multi-bssid-profile-name

#### 建立多個 SSID

### 若要驗證 MBSSID 功能,您必須啟用多個 SSID 並推送至 AP。以下驗證作業使用了三個 SSID:

Cisco Ca	talyst 9800-	CL Wireless C	ontroller	Welcome admin	* *		C     Search APs a	nd Clients Q	Feedback e <sup>A</sup> (+
Q. Search Menu Items	Configural	tion • > Tags & Pr	rofiles * > WLANs						
Dashboard	+ Add	× Delete	Clone Enable WI.	AN Disable WLAN					WLAN Wizard
	Selected W	LANs: 1							
	O Stat	Name	т	ID	т	SSID	T	Security	Ŧ
Configuration >	0 0			1		5 00 e		[WPA2][PSK][AES]	
Administration	0 0		•	2				[WPA3][FT + SAE][AES].[F	T Enabled]
~	0 0		•	3				[WPA2][PSK][AES]	
C Licensing	0 0		*	4				[WPA2][PSK][FT + PSK][AB	ES].[FT Enabled]
S. Co. T. March	0 0	wifi6E_test	•	5		wifi6E_test		[WPA3][SAE][AES]	
Troubleshooting	0 0	wifi6E_test_01	•	6		wifi6E_test_01		[WPA3][SAE][AES]	
	0 0	wifi6E_test_02	•	7		wifi6E_test_02		[WPA3][SAE][AES]	

#### 驗證

若要驗證設定是否已完成,請發出以下命令:

<#root>

WLC9800#

show ap rf-profile name default-rf-profile-6ghz detail | b 802.11ax

802.11ax OBSS PD : Disabled Non-SRG OBSS PD Maximum : -62 dBm SRG OBSS PD : Disabled SRG OBSS PD Minimum : -82 dBm SRG OBSS PD Maximum : -62 dBm Broadcast Probe Response : Disabled FILS Discovery : Disabled Multi-BSSID Profile Name :

#### MBSSIDprofile\_test

NDP mode : Auto Guard Interval : 800ns PSC Enforcement : Disabled

WLC9800# WLC9800#

show wireless profile multi-bssid detailed MBSSIDprofile\_test

Multi bssid profile name :

MBSSIDprofile\_test

-----

Description : 802.11ax parameters OFDMA Downlink : Enabled OFDMA Uplink : Enabled MU-MIMO Downlink : Enabled MU-MIMO Uplink : Enabled Target Waketime : Enabled TWT broadcast support : Enabled

WLC9800#

以下是使用單一 BSSID 時 OTA 擷取的實際內容:

A Beaco	n 6GHz singleSSID.pcapng							- a x
		Contract Accession in which the		100.00				
FVE DDG	view Go Captore A	overyze scientics interpro-	ny waters	10011 11	εφ			
A H (	🛞 🚞 🖻 🕱 💆 🤗	@ @ 監察查 ]	= Q Q (	Q. III				
A peekren	note							
	220	Dalla Carrier	Destruction	Contrard.	Annual ch	and freedoto	14. ·	> Frame 1: 358 bytes on wire (2864 bits), 358 bytes captured (2864 bits) on interface \Device\MPF (DeVice\MPF (DeV
199, 1	ine	Deta Source	Destruction	PTOSOCOR	Leiga Ci	ame signalstre	Prop	> Ethernet II, Src: Cisco dd:7d:37 (00:df:1d:dd:7d:37), Dst: Universa b7:cf:00 (00:1a:88:b7:cf:06)
1.0	N23-00-09 13123133, 200910	a partial clara dirabile	Broadcast	202.11	159	67 - 27 den	Beauto frame, SN-1734, FN-0, Flags	> Internet Protocol version 4, Src: 192.168.1.15, Dat: 192.168.1.121
3.5	11.11.11.11.11.11.11.11.11.11.11.11.11.	a tatala (inco disabile	Broadcast	882.11	150	20.00 400	Basing frame (0.17)5 Dud Elser. / BT.100 SSTD."uldid tert"	> User Datagram Protocol, Src Port: SSSS, Ost Port: S000
1.55	Rep-05-07 13-133-576215	a same cisco de acte	Broadcast	000.11	124	57 - 55 USH	Beaute frame, Swarras, File, Flags	> AiroPeek/OmiFeek encapsulated IEEE 802.11
- 23	ATT AF AB 11.11.11 TRALL	A SAMPA CLASS Advanta	Reading	202.11	100	CD 407 40m	Basedo frame, FL-1717, FL-0, Flame,	> 802.11 radio information
2.3	471.66.85 11:21:33 883478	a tatata cisco di abite	Broadcast	887.11	15.0	45 .55 day	Beacon frame Shi1718 Shidt Flame. / BT.188 SSTD."vidics test"	> IEEE 802.11 Beacon frame, Flag1:C
	ALL 00 11:11:11 00:001	a tateat clico ditabile	Broadcast	582.11	15.6	44 - 55 day	hearon frame Sh-1716 Elast. / B1-100 SSTD-"vidide test"	✓ IEEE 802.11 wireless Haragement
1.123	411.06.00 11-12-14 Additio	a serve disco di abite	Broadcast	887.11	158	60 .00 dbm	Beacon frame Chullan Elant. / BTulah SCThurnelite test"	3. Fixed narameters (12 hytes)
	971-06-09 11-73-34 190606	a sama cisco de abric	Broadcast	687.11	15.5	65 .02 dam	Bearon frame Ou-1741 Elucit Elanta / ETuton SSTD-"utilitä test"	<ul> <li>Tagged parameters (256 bytes)</li> </ul>
10.2	\$21.06.09 11:23:34 293039	e teletil cisco di abite	Broadrast	882.11	15.8	65 .02 dan	Bearon frame Shu1243 Elanta C Etulob SCTDu "ulfild tect"	✓ Tag: SSDD parameter set: "wifi6€_test"
11.2	\$71.04.09 11121114 195147	0.102328 Cisco dd:a0:10	Eroadrast	882.11	35.0	65 .25 day	Reacon frame, Chu1243, Fluid, Flamts,C. 87+100, SSTDs "wiffield test"	Tag Number: SSID parameter set (0)
12.2	971.04.09 11:21:14 400251	8. 384884 Cisco ddia8:1c	Broadcast	882.11	15.8	65 .25 dbs	Reacon frame, Sh-1765, Fluid, Flagt, C. 87-100, SSTD-"wifild test"	Tag length: 11
11 2	923-06-09 13:23:34.702459	8.187779 Cisco ddrabrir	Broadcast	887.11	15.0	40 -90 dim	Bearne frame, Sky1766, Flags, Flags, C. 87,100, SSTD, "vidics text"	SSID: "wifiet_test"
14.2	971.06.09 11:73:14.004978	a tatasa cisco dirabite	Broadcast	887.11	15.0	69 .90 dan	Bearon frame, Shu1747, ENu0, Flamts	> Tag: Supported Rates 6(8), 9, 12(8), 18, 24(8), 36, 48, 54, [MDIT/Sec]
15.2	071.06.09 11:71:15 009817	8. 204847 Cisco databile	Broadcast	882.11	150	45 .03 die	Bearon frame, Shu1749, Elud, Elasta	> Tag: Traffic Indication Hap (TIH): DTIH 2 of 3 bitmap
16.2	923-06-05 13:23:35-112220	8.183451 Cisco dirabite	Broadcast	887.11	158	65 .03 dan	Bearon frame, Shu1758, Fluid, Flams,C. 87u100, SSTDu "ulfifs test"	> Tag: Country Information: Country Code na, Environment Global operating classes
17 2	921-06-09 13123135-214642	e.sector disease	Broadcast	882.11	35.8	49 .09 dim	Beacon frame, Sku1751, Fluid, FlagtsC. #1u100, SSIDs"ulfide test"	> Tag: Power Constraint: 6
18.2	021-06-09 11:23:35,316963	8.582321 Cisco ddrae:1c	Broadcast	882.11	152	69 -52 dim	Beacon frame, Stu1752, Flud, Flagts	> Tag: TPC Report Transmit Power: 16, Link Margin: 0
19 2	921-06-09 13:23:35.419339	0.102176 Cisco dd:a0:1c	Eroadcast	882.11	154	69 -89 d8m	Beacon frame, Shu1751, Fluid, Flamiu	> Tag: RSN Information
20 2	923-06-09 11:21:15.521836	0.102497 Cisco dd:a0:1c	Broadcast	882.11	358	69 -89 dam	Beacon frame, Shu1754, Fluid, FlagsuC. BIuldd, SSIDu"uifisE test"	> Tag: Q855 Load Element 802.11e CCA Version
21 2	023.06.09 13:23:35.624107	0.102271 Cisco dd:a0:1c	Broadcast	882.11	15.8	69 .55 dbs	Beacon frame, Shu1755, Fluid, Flags,	> Tag: RH Enabled Capabilities (5 octets)
22.2	023-06-09 13:23:35,726573	e.102466 Cisco ddia0:1c	Broadcast	882.11	158	65 .29 dim	Beacon frame, Sha1756, Flagt, Flagt,	> Tag: Extended Capabilities (11 octets)
23.2	021-06-09 11:23:36.033780	0.307207 Cisco dd:a0:1c	Broadcast	\$82.11	154	69 -88 dBm	Beacon frame, Shu1759, Flug, Flagty	> Tag: Tx Power Envelope
24.2	971.06.09 11:21:36 116109	B. 187379 Claro dirak-1r	Econdrast	887.11	15.0	65 .05 dam	Bearce frame, Skut268, Skut 268, Elasta	> Tag: Tx Power Envelope
25.2	023-06-09 13:23:36,230561	0.102452 Cisco dd:a0:1c	Ercadcast	802.11	358	65 -89 dan	Beacon frame, SN+1761, FN+0, Flags+C. BI+180, SSID+"wifi68 test"	<ul> <li>Ext Tag: Multiple BSSID Configuration</li> </ul>
26.2	023-06-09 13123136-340953	8.183422 Clisco ddia811c	Broadrast	887.11	155	45 .53 dds	Bearon Frane, Shut262, Hud. (Japta,	Tag Number: Element ID Extension (255)
27.2	023-06-09 13:23:36.443393	0.102410 Cisco dd:a0:1c	Broadcast	802.11	358	69 -89 dim	Beacon frame, SNu1763, Fluid, FlagtuC. 81u100, SSIDu"wifi68 test"	Ext Tag length: 2
28.2	923-06-09 13:23:36.651208	0.207815 Cisco dd:a0:1c	Broadcast	882.11	158	69 -92 dBm	Beacon frame, SN+1765, Fluid, Flagt+C. 81+100, SSID+"wifi6E test"	Ext Tag Number: Multiple BSSID Configuration (SS)
29.2	023-06-09 13:23:36,753501	0.102293 Cisco dd:e0:1c	Broadcast	882.11	158	69 -91 dBm	Beacon frame, SN+1766, FileD, FlagtyC, BI+100, SSID+"wifi6E test"	855D Counti 1
20.2	023-06-09 13:23:36,856275	0.102774 Cisco dd:e0:1c	Broadcast	892.11	158	69 -90 dam	Beacon frame, SN+1767, FN+0, Flags+C. BI+100, SSID+*wifi6E test*	Full Set 8x Periodicity: 1
31.2	923-06-09 13:23:36,958344	0.102069 Clsco dd:a0:1c	Broadcast	002.11	358	65 -50 dan	Beacon frame, SN+1768, FN+0, Flags+C. 81+100, SSID+"wifi68 test"	> Ext Tag: +6 Copabilities
32.2	#23-06-09 11:23:37-060687	0.102343 Cisco dd:a0:1c	Broadcast	882.11	358	65 .50 dim	Beacon frame, Sha1769, Flags, Flags,	> Ext Tag: HE Operation
13 2	023-06-09 13:23:37.265594	0.204907 Cisco dd:a0:1c	Broadcast	882.11	158	69 -90 d8m	Beacon frame, SN+1771, FN+0, Flags+C, 81+100, SSID+"wifi68 test"	> Ext Tag: Spatial Reuse Parameter Set
34 2	023-06-09 13:23:37.360108	0.102594 Cisco dd:a0:1c	Broadcast	\$82.11	155	69 -90 dbm	Beacon frame, SN+1772, FH+0, Flags+C, #I+100, SSID+"wifi6E test"	> Ext Tag: HU EDCA Parameter Set
35 2	023-06-09 13:23:37.572795	0.204607 Cisco dd:00:1c	Broadcast	802.11	358	65 -89 d8m	Beacon frame, SN+1774, FN+0, Flags+C, BI+100, SSID+"wifi6E test"	> Ext Tag: HE & GHZ Band Capabilities
36 2	923-06-09 13:23:37,675106	0.102311 Cisco dd:00:1c	Broadcast	802.11	358	65 -89 ddm	Beacon frame, SN+1775, FN+0, Flags+C, BI+100, SSID+"wif168 test"	> Teg: RSW extension (1 octet)
37.2	823-06-09 13:23:37.777598	0.102484 C15C0_0010011C	Broadcast	882.11	356	69 -90 d8m	Beacon frame, SN+1776, FN+0, Flags+C, BI+100, SSID+"wifi6E_test"	> Tag: Vendor Specific: Atheros Communications, Inc.: Unknown
38.2	923-06-09 13:23:37.982432	0.204842 Cisco_dd:a0:1c	Broadcast	802.11	158	69 -89 däm	Beacon frame, Stu-1778, Flud, Flags+C, BI+100, SSID+"wifi6E test"	> Tag: vendor Specific: Microsoft Corp.: WMV/WME: Parameter Element
39 2	#23-06-09 13:23:38.084776	0.102344 Cisco_dd:a0:1c	Broadcast	\$92.11	358	69 -09 d8m	Beacon frame, SN=1779, FH=0, Flags=C, BI=100, SSID="wifi6E_test"	> Tag: Vendor Specific: Cisco Systems, Inc: Aironet Unknown (44)
40 2	023-06-09 13:23:38.187243	0.102467 Cisco_dd:e0:1c	Broadcast	802.11	158	69 -89 d8m	Beacon frame, SN+1700, FN+0, Flags+C, BI+100, SSID+"wifi6E_test"	> Teg: Vendor Specific: Cisco Systems, Inc: Aironet Unknown (11) (11)
41 2	023-06-09 13:23:30.391985	0.204742 Cisco_dd:00:10	Broadcast	802.11	358	65 -50 dan	Beacon frame, SN+1782, FN+0, Flags+C, BI+100, SSID+"wifi68_test"	> Tag: Vendor Specific: Cisco Systems, Inc: Aironet Client MFP Disabled
42.2	#23.06.09 11123138.494294	0.102309 Clsco ddra011c	Broadcast	882.11	358	65 -89 d8m	Beacon frame, Shu1783, Fluid, Flagsw	> Tag: Vendor Specific: Clsco Systems, Inc: Aironet CCX version = 5

以下是使用多重 BSSID 時 OTA 擷取的實際內容:

bill View Go Captore	Analyze Metallics Riepba	my Wreless	lools H	rip			
TTO BXB	4. 64 66 8 至 1	a d d e	4.11				
skremote							
Image         Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image           Image         Image         Image         Image         Image         Image           Image         Image         Image         Image         Image         Image         Image           Image	Image: section of the sectio	Centradicat Productat	B         III           Probool         100.11           100.11	Long Out 2015 2015 2015 2015 2015 2015 2015 2015	Open         Separal strep           0         3	196           196           196           196           196           196           196           196           196           197           198	<pre>// Constant Size (See Section 2014) Size (Section 2014) Size</pre>

無線用戶端的 AP 探索

探索是指用戶端裝置啟動或進入建築物時,裝置尋找可連線存取點的這個過程。

執行探索最簡單的方法,也是今日最多用戶端裝置採用的方法,就是透過傳輸一或多個探查請求來 掃描頻道,然後接聽區域內存取點的回應、檢查探查回應是否有任何 SSID 符合用戶端的設定檔 ,接著進入下一個頻道。

這種方法有三個缺點:

- 耗費大量時間,當無線電離使用的頻道很遠時,可能會影響應用程式效能
- 透過無線方式使用大量探查請求和回應訊框,這會降低傳輸效率
- 影響用戶端電池壽命

每個非 DFS 頻道耗費的時間約 20 毫秒, DFS 頻道的耗時則長達 100 毫秒, 這在 5 GHz 頻帶中儼 然已是不能忽視的問題。 當我們意識到Wi-Fi 6E客戶端可能必須掃描頻段內59個可能的20 MHz通 道中的每一個通道才能發現所有可用的存取點時, 這一點就變得更為重要。

傳統方法(即被動掃描和主動掃描)在 6 GHz 上無法擴大執行。2.4 5 GHz 和 5 GHz 使用「全面搜 查」(hunt-and-seek) 方法(被動掃描或主動掃描)為 AP 掃描 BSSID:



傳統做法中,無線裝置是透過交換特定資訊來與存取點通訊。用戶端裝置使用主動「全面搜查」做 法來掃描附近的 AP。

這種主動掃描做法會沿著 2.4 GHz 和 5 GHz 頻譜傳送探查請求訊框。AP 會回應包含所有必要基本 服務集 (BSS) 資訊的探查回應訊框,以建立網路連線。

這些資訊包含 SSID、BSSID、頻道頻寬及安全資訊。

現在已不必採取這種「全面搜查」網路連線做法,而且向多個頻道廣播探查請求的方式如今顯得效 率低落,其實也不建議在 Wi-Fi 6E 的 6 GHz 頻帶上使用。

WiFi 用戶端只能在 20 MHz 頻道傳送探查請求,而 6 GHz 的上限為 59x20 MHz,換句話說,用戶 端可能必須掃描全部 59 個頻道,最多需花 6 秒才能被動掃描完 59 個頻道:



Wi-Fi 6E 有幾個新的 AP 探索機制:



截至本文撰寫之際,Windows/Intel 和 Android 用戶端已完成對支援 FILS 和廣播探查回應的測試 ,但 Apple 和部分 Android 用戶端並未完成,因此可能不支援 FILS 或廣播探查回應。

考量到這個問題,一般認為首選掃描頻道 (PSC) 較為適當。然而,由於目前不同無線用戶端廠商可 能不完全相容於 WiFi 6 掃描,因此只設定 6 GHz WLAN/SSID 並非理想做法。



注意:如果要確保瞭解每個客戶端支援的發現機制,您必須聯絡無線客戶端供應商支援。

根據無線用戶端廠商提供的支援,目前的理想做法是在啟用 2.4/5 Ghz 的情況下進行頻外探索,使用 Reduced Neighbor Reporting (RNR) 選項,藉由接聽來自 AP 的 2.4/5 Ghz 信標中所包含的 RNR 資訊元素,無線用戶端可探索該 AP 上的 6 GHz SSID。

WLC 和 AP 不太可能只提供 6 GHz WLAN,最常見的情況是同時廣播其他 WLAN。若將此情況列 入考量,針對不支援頻內探索機制的用戶端裝置,建議使用傳統頻帶只在 WLAN 上透過 RNR 資訊 元素通告 6 GHz 。

這麼做最終不會增加設定負擔,因為 Wi-Fi 6E 裝置本來就支援 RNR 功能,因此 Wi-Fi 6E 裝置可支援此做法。

頻外

帶外發現用於所有3個頻帶(2.4、5和6 GHz)上的交叉通訊。 802.11v中引入的此方法稱為精簡鄰

居報告(RNR)。

基本上,支援 Wi-Fi 6E 的 AP 所傳送的探查回應訊框中,會包含有關其 6 GHz 無線電的 RNR 資訊 (連同 2.4 GHz 或 5 GHz 頻帶的基本服務集 (BSS) 資訊)。

此 RNR 提供充分的資訊,可讓用戶端裝置在 6 GHz 和 2.4 GHz 或 5 GHz 網路之間漫遊。

摘要:用戶端只會透過傳統頻帶使用 RNR 來探索 6 GHz 的 WLAN,不會直接掃描 6 GHz。

如果擷取 2.4 GHz 或 5 GHz 的無線流量,會觀察到探查回應。

在 2.4 GHz、5 GHz 和 6 GHz 上廣播的 SSID 頻道 1 (2.4GHz) 上,探查回應的預期 OTA 擷取範例 如下:



## 您可看到 RNR 回報 6 GHz 頻道 5 上的相同 SSID 和另外 2 個 BSSID。

這是針對同一個 SSID, 但探查回應位於 5 GHz:



帶內發現用於6 GHz裝置之間的通訊,有三種帶內發現方法:

- 快速初始連結設定 (FILS) 和未經請求的探查回應 (UPR) 訊框,這兩項屬於被動式頻內探索方法。FILS 和 UPR 擇一,不能同時使用。只有在 6 GHz 是唯一可運作的無線電頻帶時,才需要用到 6 GHz 探索訊框。
- 首選掃描頻道 (PSC) 是主動式頻內探索方法。 無線用戶端只會探查 PSC 頻道;如果是從 RNR 偵測,則會掃描非 PSC。

請記得這些是頻內探索方法,只適用於在 6 GHz 頻帶中連接無線網路的 Wi-Fi 6E 用戶端。

FILS

FILS 來自 IEEE 802.11ai 標準,作用為改善網路與 BSS 探索、身分驗證與關聯、DHCP 和 IP 位址 設定。

FILS 使用「探索公告訊框」,本質上就是濃縮版信標訊框。FILS 訊框只會傳送重要資訊:短 SSID、BSSID 和頻道,供 AP 決定要連線的 AP。

如果已設定 FILS,6 GHz AP 大約每 20 毫秒會廣播一次公告探索訊框,這樣會縮短無線傳輸時間 並減少探查請求額外負荷。



附註:只有在 6 GHz 是唯一可運作的無線電頻帶時,才需要用到 6 GHz 探索訊框。若有其 他無線電頻帶 (2.4/5 GHz) 可運作,用戶端會從 RNR IE 偵測 6 GHz。

在 RF 設定檔中設定 FILS 探索訊框 (GUI)

步驟 1: 選擇「設定」>「標籤和設定檔」>「 RF/無線電」。

步驟 2:在 RF 索引標籤中,按一下新增。「新增 RF 設定檔」頁面會隨即顯示。

步驟 3: 選擇 802.11ax 索引標籤。

步驟 4:在 6 GHz 探索訊框區段中,按一下 FILS 探索選項。



附註:為了防止 RF 設定檔中的探索訊框設為無時傳輸探索 FILS 訊框,請務必在 AP 上選 取「廣播探查回應」選項以切換到 5-GHz 或 2.4-GHz 頻帶,停用 FILS 探索訊框。

## 步驟 5:按一下套用至裝置。

Confi	guration *	Tags & Profiles * > RF/Radio		Edit RF Profile					
RF	Radio			General 802.11 RRM Advanced	General 802.11 RRM Advanced 802.11ax				
hboard itoring	+ Add	× Dulate		6 GHz Discovery Frames ①	None     Straedcass Probe Response     FILS Discovery				
and the second second	State	T RF Profile Name	T Band	Readerst Date Research Internal (merch)					
onnguration >	0	default-rf-profile-6ghz	6 GHz	Broadcast Probe Wisponse Interval (Insec)	20				
dministration , 🖸	0	Low_Client_Density_rf_5gh	5 GHz	Multi BSSID Profile	MBSSIDprofile_test •				
0	0	High_Client_Density_rf_5gh	5 GHz	Snatial Barree					
icensing O	0	Low_Client_Density_rf_24gh	2.4 GHz	opena recoe					
	0	High_Client_Density_rf_24gh	2.4 GHz	OBSS PD	DISABLED				
O	0	Typical_Client_Density_rf_5gh	5 GHz						
0	0	Typical_Client_Density_rf_24gh	2.4 GHz	Non-SNG UBSS PD Max I nreshold (dbm)*	-62				
	+ 1	P P 10 T		SRG OBSS PD	DISABLED				
A Me Thousand an				SRG OBSS PD Min Threshold (dBm)*	-82				
				SDC ORSS DD May Threathald (dBm)+	-63				

#### 在 RF 設定檔中設定 FILS 探索訊框 (CLI)

Device# configure terminal Device(config)# ap dot11 6ghz rf-profile rf-profile-name Device(config-rf-profile)# dot11ax fils-discovery

#### 驗證

若要驗證組態是否已設定完成,請發出 show 命令,如下所示:

#### <#root>

WLC9800#

show ap rf-profile name default-rf-profile-6ghz detail | b 802.11ax

802.11ax OBSS PD : Disabled Non-SRG OBSS PD Maximum : -62 dBm SRG OBSS PD : Disabled SRG OBSS PD Minimum : -82 dBm SRG OBSS PD Maximum : -62 dBm Broadcast Probe Response : Disabled

FILS Discovery : Enabled

Multi-BSSID Profile Name :

MBSSIDprofile\_test

NDP mode : Auto Guard Interval : 800ns PSC Enforcement : Disabled

以下是擷取傳輸中無線流量時預期會看到的內容:



您可以發現訊框之間的差異大多約為 20 毫秒,不過有時會達到約 40 毫秒。查看訊框序列後得出結 論,監聽器 AP 擷取 FILS 訊框時偶爾會遺漏。

UPR

未經請求的探查回應 (UPR) 訊框包含信標所含的所有資訊,也就是承載著多重 BSSID 和建立關聯 所需的所有資訊。

若使用這種訊框,6 GHz AP 每 20 毫秒會廣播一次完整的探查回應訊框,這樣有助於避免發生探查 風暴。

6 GHz 有幾項新的探查限制:

- 用戶端無法執行盲探查,也就是不允許使用包含萬用字元 SSID 和 BSSID 的廣播目的地位址 ,因為包含萬用字元 SSID 的探查請求和探查會導致探查風暴並影響效能。
- 用戶端至少須等待最短探查延遲間隔時間(約 20 毫秒)。
- 系統一律會廣播探查回應。

UPR 也稱為「廣播探查回應」,下一節將說明啟用方式。

在 RF 設定檔中設定廣播探查回應 (GUI)

步驟 1: 選擇「設定」>「標籤和設定檔」>「 RF/無線電」。

步驟 2 : 在 RF 索引標籤中,按一下新增。「新增 RF 設定檔」頁面會隨即顯示。

步驟 3: 選擇 802.11ax 索引標籤。

步驟 4:在 6 GHz 探索訊框區段中,按一下廣播探查回應選項。

步驟 5:在廣播探查回應間隔欄位中,輸入廣播探查回應間隔時間(毫秒)。值的範圍介於 5 到 25 毫秒。預設值為 20 毫秒。

### 步驟 6: 按一下套用至裝置。

	Config	uration *	> Tags & Profiles * > RF/Radio		Edit RF Profile		×
Q Search Mena Isens	RF	Radio			General 802.11 RRM Advanced	802.11ax	
Dashboard     Monitoring		Add	× Delete		6 GHz Discovery Frames ③	None     Broadcast Probe Response     FLS Discovery	]
		State	Y RF Profile Name	▼ Band		C no manny	
Configuration >	0	0	default-rf-profile-6ghz	6 GHz	Broadcast Probe Response Interval (msec)*	20	
Administration	0	0	Low_Client_Density_rf_5gh	5 GHz	Multi BSSID Profile	MBSSIDprofile_test +	2
	0	0	High_Client_Density_rf_5gh	5 GHz	Spatial Derree		
C Licensing	0	0	Low_Client_Density_rf_24gh	2.4 GHz	Spatial Redde		
	0	0	High_Client_Density_rf_24gh	2.4 GHz	OBSS PD	DISABLED	
S Troubbarrowing	0	0	Typical_Client_Density_rf_5gh	5 GHz	Mar. CDC ODCC OD May Threakald (4Dea)*		
	0	0	Typical_Client_Density_rf_24gh	2.4 GHz	Non-Skig Obas PD Max Inteshold (dbm)-	-62	
		1	9 N 10 V		SRG OBSS PD	DISABLED	
Walk Me Through 2					SRG OBSS PD Min Threshold (dBm)*	-82	
					SRG OBSS PD Max Threshold (dBm)*	-62	

### 在 RF 設定檔中設定廣播探查回應 (CLI)

```
Device# configure terminal
Device(config)# ap dot11 6ghz rf-profile rf-profile-name
Device(config-rf-profile)# dot11ax bcast-probe-response
Device(config-rf-profile)# dot11ax bcast-probe-response time-interval 20
```

#### 驗證

## 若要驗證組態是否已設定完成,請發出 show 命令,如下所示:

#### <#root>

WLC9800#

show ap rf-profile name default-rf-profile-6ghz detail | b 802.11ax

802.11ax OBSS PD : Disabled Non-SRG OBSS PD Maximum : -62 dBm SRG OBSS PD : Disabled SRG OBSS PD Minimum : -82 dBm SRG OBSS PD Maximum : -62 dBm

```
Broadcast Probe Response : Enabled
Broadcast Probe Response Interval : 20 msec
```

FILS Discovery : Disabled Multi-BSSID Profile Name :

MBSSIDprofile\_test

NDP mode : Auto

使用 UPR (廣播探查回應)時,無線傳輸情況如下:

		2.0000000000000000000000000000000000000	1211111			112	forme any one house of the black with the black cost and there black and the lot of the design of the design and the sets state and the sets
No	Time Delta Source	Destination	Protocol	Lengti Channel Signals	re Info	112	Frame 97: 458 bytes on kire (3664 bits), 458 bytes captured (3664 bits) on interface (Device/MPT_[04578985-2998-4456-8633-C34316643
100	4 2023-06-09 15:06:58.201915 0.000000 Cisco_13:80:ec	Broadcast	802.11	458 5 -36 d8	Probe Response, SH=1402, FN=0, Flags=C, HI=100, SSID="wd	112	Ethernet II, Srci CLSco_00170137 (00107120100170137), DSCI Universe_07107106 (00138180107107106)
	12 2023-06-00 15:06:58.224175 0.022260 Cisco_13:00:ec	Broadcast	802.11	453 5 -36 d8	Probe Response, SN+1401, FN+0, Flag1+C, BI+100, SSID+"wd		Internet Protocol Version 4, Src: 192.168.1.15, DSt: 192.168.1.121
	14 2023-06-09 15:06:58.245393 0.021218 Cisco 13:00:ec	Broadcast	802.11	505 5 -16 dt	Beacon frame, SN+1404, FN+0, Flags+C, BI+100, SSID+"wiff	1.2	User Datagram Protocol, Src Port: 5555, Dst Port: 5000
	25 2023-06-09 15:06:58-263659 0.018266 51570 13:88:07	(Ecoadrast	882.11	455 5 .38 .08	Prote Recourse Chutant, Plug, Flags,		AiroPeek/OmniPeek encapsulated IEEE 002.11
	28 2023-06-09 15:06:58,283984 0.020325 Cisco 13:80:ec	Broadcast	882.11	418 5 .18 d8	Probe Ressonce, Shutable, Flugs, Flags,	1	802.11 radio information
	10 1011-06-00 15-06-58 104404 8 010410 Fires 11-08-or	Broadcast	887 11	450 5 .10 .40	Broke Bernotse, Olulian Diuk Elerte, / ETutak CONutur	1	IEEE 042.11 Probe Response, Flags:C
	18 JANIA AN AN ANALYZE ANTIAN A ANALYZE FILLER ANALYZE	Readdant	4412 41	46.0 6 10 40	Banks Bacanasa (B. 1988, Dr.A. Flass- / BT.188, FTD.54	×	IEEE 002.11 wireless Management
	in any were as we see that the second state of the second	Constant,		494 9 798 68	the service and the state of the service of the ser		> Fixed parameters (12 pytes)
	40 2023-06-09 15:06:58.345526 0.020343 C15C0_13:00:0C	Brosocast	002.11	545 5 -34 08	BERCON TRANE, SNALWER, FRAND, FLAGTA, BLAINE, SSIDA MITI		Tagged parameters (356 bytes)
	53 2023-06-09 15:06:50.365012 0.020286 C15C0_13:00:0C	Broadcast	002.11	458 5 - 38 08	Probe Response, SN+1410, FN+0, Flegs+C, 01+100, SSID+"HD		1 Tapi SCO, sanaastar cati "vifiga tact at"
	55 2023-06-09 15106150-401509 0.035777 C15C0_1310016C	BLOBOCARE	302.11	458 5 - 38 08	Probe Response, SN+1411, PN+0, Flags+C, B1+100, SSID+"HD		5 Tagi Supported Bates 2(8) 8 13(8) 18 54(8) 14 28 84 (10)(1/car)
	60 2023-06-09 15:06:50.409694 0.000105 C1sco_13:80:ec	Broadcast	802.11	458 5 -38 d8	Probe Response, SN+1412, FN+0, Flags+C, BI+100, SSID+"HI		<ul> <li>The support the first start (my) of all (my) of a start (my) of a</li></ul>
	68 2023-06-09 15:06:58.427288 0.017594 Cisco_13:80:ec	Eroadcast	802.11	458 5 -38 d8	Probe Response, SN+1413, FN+0, Flags+C, BI+100, SSID+"Hi		2 Tegi Country Anterneticiani Country Cole Fey Enterometric Gauge Operating Casises
	71 2023-06-09 15:06:58.447023 0.020535 Cisco_13:00:ec	Broadcast	802.11	505 S -38 d8	Beacon frame, SN+1414, FN+0, Flags+C, BI+100, SSID+"wifi		> tag: Power constraint: e
	82 2823-06-09 15:06:58.468143 0.020320 Cisco_13:00:ec	Broadcast	602.11	458 5 -38 dB	Probe Response, SN+1415, FN+0, Flags+C, 01+100, SSID+"wi		> Tag: TeC Report Transmit Power: 17, Link Hargin: 0
	87 2823-06-09 15:06:58.488694 0.020551 Cisco_13:00:ec	Broadcast	802.11	458 5 -38 d8	Probe Response, SN+1416, FN+0, Flags+C, BI+100, SSID+"wi		> Tag: OBSS Load Element B02.11e CCA Version
	89 2023-06-09 15:06:58.509174 0.020480 Cisco_13:80:ec	Broadcast	802.11	458 5 -38 dB	Probe Response, SN+5417, FN+0, Flags+C, BI+100, SSID+"vd		Tag: Multiple #SSID
100	97 2023-06-09 15:86:58.529726 0.020552 Citco 13:80:00	Broadcast	802.11	458 5 -38 dB	Probe Response, Shuldin, Flue, FlagtuC. HI-100, SSIDu "vd		Tag Number: Multiple #SSID (71)
	101 2021-06-09 15:06:58 550183 0.020457 Cisco 13:80:07	Broadcast	802.11	sec 5.10 da	Beacon frame, Shutath, Hud, Flanks,		Tag length: 138
	114 3831.04.08 15:04:05 570545 0.035183 75440 13:08:42	Recorderast	882.11	455 8 .38 48	Broke Bernotce, Chuldha Hud, Flagt, / BTutas, 5575-54		Max #SSID Indicator: 4
	117 ABID AL AD 15-AL-ED EDIDLE A ANALIDA CLICO 12-BB-AC	Renadrant		450 5 10 40	Books Recently Divide, They Talgerint they barren, Jakow R.		✓ Subelement: Nontransmitted #SSID Profile
	110 3033 00 40 10 00 50 501035 0.000400 0.000_010.00.00	Benedicask	000.111	450 5 - 30 40	Broke Response, Swijedd, Filer, Filese, C. BT. the CET. 7.4		Subelement ID: Nontransmitted #SSID Profile (0)
	ANY STREPTOP AND DEVELOP TRADES CANCELED	Brown ass		454 5 554 44	From Response, Sources, From, Fingstonen, C. Barton, Source to		Length: 45
	12/ 2023-06-09 19:00:58.632008 0.020284 C15C0_13:00:6C	#rosocast	902.11	456 5 -36 08	Probe Response, Snasas), Pawe, Plagsa		Nontransmitted Profile: Sh2111500057205225324555734555126105105100000fsc040100000fac04010000fac0400000fac0400000fac0400000fac0400000fac0400000fac0400000fac040000000000
	130 2023-06-09 15:06:58.652658 0.020650 CISCO_13:00:0C	erosocast	002.11	545 5 -38 08	Bescon trane, Shelele, Field, Fidgle		> Tar: Non Transmitted #SSID Canability
	140 2023-06-09 15106158.673068 0.020410 C15C0_1310010C	Broadcast	392.11	458 5 - 38 08	Probe Response, SN+1425, PN+0, Flags+C, 81+100, SSID+"HD		Tage CSTD samaneter (at) Sulfice tect"
	143 2023-06-09 15106158-693526 0.020458 C1sco_131001ec	Broadcast	802.11	458 5 -36 08	Probe Response, SN+1426, FN+0, Flags+C, BI+100, SSID+"w1		Tapi milting strong today
	146 2023-06-09 15:06:50.713903 0.020457 C1sco_13:00:ec	Broadcast	802.11	458 5 -36 d8	Probe Response, Six1427, Fixe, Flags+C, BI+100, SSID="will		- Tag, Patagat and a start and a
	154 2023-06-09 15:06:58.734465 0.020402 C1sco_13:00:ec	Broadcast	802.11	450 5 -36 dB	Probe Response, SH+1428, FN+0, Flags+C, BI+100, SSID+"wd		<ul> <li>The attraction of actual</li> </ul>
	156 2023-06-09 15:06:58.754950 0.020493 Cisco_13:00:ec	Broadcast	882.11	505 5 -36 dB	Beacon frame, SN+1429, FN+0, Flag1+C, BI+100, SSID+"Hifi		r reg, have extended (a viete)
	168 2023-06-09 15:06:58.775508 0.020550 Cisco_13:00:ec	Broadcast	882.11	458 5 -36 dB	Probe Response, SN+1430, FN+0, Flags+C, BI+100, SSID+"wi		> Tag: vendor specific: Cicco Systems, Inc: Alfonet Unknown (++)
	171 2023-06-09 15:06:58.795844 0.020336 Cisco_13:80:ec	Broadcast	882.11	458 5 -36 d8	Probe Response, SN+1431, FN+0, Flags+C, 81+100, SSID+"wd		) ing: venoor specific: Lisco systems, inc: Aironet Unknown (ii) (ii)
	176 2023-06-09 15:06:50.016300 0.020536 Cisco_13:00:ec	Broadcast	892.11	458 5 -36 d8	Probe Response, SN+1432, FN+0, Flags+C, BI+100, SSID="wd		Subsiement: Northansmitted #5510 Profile
	184 2023-06-09 15:06:58.036807 0.020507 Cisco_13:00:ec	Broadcast	802.11	458 5 -36 d8	Probe Response, SN+1433, FN+0, Flags+C, BI+100, SSID+"wd		Subelement ID: Nontransmitted #3510 Profile (#)
	187 2023-06-09 15:06:58.057494 0.020607 Cisco_13:00:ec	Broadcast	802.11	505 5 -36 dB	Beacon frame, SN+1434, FN+0, Flags+C, BI+100, SSID+"wifi		Length: 48
	201 2023-06-09 15:06:58.077924 0.020430 Cisco_13:00:ec	Broadcast	802.11	458 5 -36 d8	Probe Response, SN+1435, FN+0, Flags+C, BI+100, SSID+"wi		Nontransmitted Profile: \$30211150000776966693645517465737457303255020301a02000007ac0401000007ac
	212 2023-06-09 15:06:58.898394 0.020470 Cisco 13:80:ec	Broadcast	882.11	453 5 -34 dB	Probe Response, SN+1436, FN+0, Flags+C, 81+100, SSID+"vd		> Tag: Non Transmitted BSSID Capability
	217 2023-06-09 15:06:58.918787 0.020393 Cisco 13:80:ec	Broadcast	802.11	453 5 -36 d8	Probe Response, Shul437, Phu0, Flags+C, #I+100, SSID+"wd		> Tag: SSID parameter set: "w1f168_test_02"
	226 2023-06-09 15:06:58.939279 0.020492 Cisco 13:00:ec	Broadcast	887.11	458 5 -36 de	Probe Response, Shulald, Flue, FlagsC. Eluide, 5510w"wd		> Tag: Multiple BSSID Index
	231 2023-06-09 15:06:58,959825 0.020546 Cisco 13:00:ec	Eroadcast	882.11	505 5 -36 dB	Beacon frame, SNu1439, FNu0, Flags		> Tag: RSW Information
	242 2823.04.09 15:04:58 558255 0:020434 Cisco 13:88:er	Broadcast	882.11	458 5 . 16 .08	Broke Becontce, Chutada, Hugh, Elarce, C. Stutas, CCTD-Sul		> Tag: RSN extension (1 octet)
	258 2821-06-09 15:00:55 000666 0.020107 (1550 11:00:65	Eroadcast	882.11	45.0 5 .16 40	Probe Rectores, Stutist, Stud. Flags		> Tag: Vendor Specific: Cisco Systems, Inc: Aironet Unknown (44)
	NET TATE AS	Broadrach	883 33	468 6 . 16 48	Broke Barnonce Ch-1441 Da-h Class- / DT-188 CCT0-5-4		> Tag: Vendor Specific: Cisco Systems, Inc: Aironet Unknown (11) (11)
	AND ARED TO BE AFTER AND AND A AND A AND A AND A AND AND AND	Erondinch		100 0 100 00	Banks Bananasa for 1915 for a filmer of an and form the		> Tag: RV Erabled Cacabilities (5 octets)
	263 2023-06-09 15:06:59-0415/5 0.0209319 C15C0_13:00:0C	Broadcast	882.11	456 5 -36 08	Proce Response, shapeas, Pikes, Pilesk		> Tag: Extended Capabilities (11 octets)
	26/ 2023-06-09 15:06:59.0622/6 0.020/01 C15C0_13:00:0C	Broducest	002.11	505 5 -39 GE	Beacon trane, Sneleee, Fnee, Flagse		> Ext Tar: wE Canabilities
	280 2023-06-09 15:06:59.002758 0.020482 C15C0_13:00:0C	Broadcast	002.11	458 5 - 36 08	Probe Response, SN+1445, FN+0, Flags+C, BI+100, SSID+'WI		> Ext Tax: HE Operation
	283 2023-00-09 15:00:59.103117 0.020359 C15C0_13:00:0C	Broapcast	002.11	456 5 - 36 68	Probe Response, SN+1446, PN+0, PlagS+C, B1+100, SSID+"WI		> Ext Tag: wE 6 Ger Band Carabilities
	287 2823-00-09 15:00:59.123795 0.020678 C1500_13:00:60	erosocast	202.11	450 5-36 de	Probe Response, Sn+2447, Phue, Piegs+C, BI+100, SSID+"WI		> Eve Tag: Coatial Bauca Parameter Cat
	296 2023-06-09 15:06:59.144460 0.020665 Cisco_13:80:ec	Broadcast	882.11	458 \$ -36 d8	Probe Response, Sta1448, Fta0, FlagsC, 81a100, SSIDa"w1		S to the rest of the second se
	300 2023-06-09 15:06:59.164096 0.020436 C15c0_13:00:#c	Broadcast	802.11	505 5 -36 da	Beacon frame, SN+1449, FN+0, Flags+C, BI+100, SSID+"wifi		C Set upp or Section House of Area - Langer Baranter Flammat
	312 2823-06-09 15:06:59.185064 0.020168 Cisco_13:00:ec	Broadcast	002.11	458 5 -36 68	Probe Response, SN+1450, FN+0, Flags+C, 01+100, SSID+"wi		<ul> <li>reg. revenue approximation, restricted procession databased</li> <li>reg. revenue fractification databased fractioner in television</li> </ul>
	316 2023-06-09 15:06:59.205685 0.020621 Cisco_13:80:ec	Broadcast	882.11	458 5 -36 dB	Probe Response, SN+1451, FN+0, Flags+C, 01+100, SSID+"wi		<ul> <li>reg. model spectral matrix community and second</li> <li>tas under far filtr matrixes for</li> </ul>
	321 2023-06-09 15:06:59.225980 0.020295 Cisco_13:80:ec	Broadcast	302.11	458 5 -36 d8	Probe Response, SH+1452, FN+0, Flags+C, BI+100, SSID+"w1		<ul> <li>Tigs: Permit Application and a second se Second second sec</li></ul>
	330 2023-06-09 15:06:59.246504 0.020524 Cisco_13:00:ec	Broadcast	\$82.11	458 5 -36 d8	Probe Response, SN+1453, FN+0, Flags+C, 81+100, SSID+"wi		<ul> <li>regis may extension (a when)</li> </ul>
	333 2023-06-09 15:06:59.267056 0.020552 Cisco_13:00:ec	Broadcast	802.11	505 5 -36 da	Beacon frame, SN+1454, FN+0, Flags+C, BI+100, SSID+"wifi		/ 18g. IA PARE ENTRADE
	345 2823-66-09 15:06:59.287383 0.020327 Cisco_13:00:ec	Broadcast	002.11	458 5 -36 d8	Probe Response, SN+1455, FN+0, Flags+C, 01+100, SSID+"HI		v regis in symple sources/symple

### PSC

Wi-Fi 6E 的第三種探索方法為主動執行的首選頻道掃描 (PSC)。實際上,這是唯一允許 Wi-Fi 6E 用 戶端裝置傳送探查請求的方法。

針對 1200 MHz 頻譜和 59 個新的 20 MHz 頻道,若站台對每個頻道的駐留時間為 100 毫秒,需要 將近 6 秒才能完成整個頻帶的被動掃描。

若使用 PSC,用戶端裝置只能對每四個 20 MHz 頻道傳送一次探查請求。 PSC 以 80 MHz 為間隔 ,因此用戶端只需掃描 15 個頻道而不是 59 個。

6 GHz PSC 頻道完整清單為 5、21、37、53、69、85、101、117、133、149、165、181、197、 213 和 229。



PSC 頻道

在 RF 設定檔中設定首選掃描頻道 (GUI)

步驟1:選擇「設定」>「標籤和設定檔」>「RF/無線電」。

步驟 2:在 RF 索引標籤中,按一下新增。「新增 RF 設定檔」頁面會隨即顯示。

步驟 3: 選擇 RRM 索引標籤。

步驟 4: 選擇 DCA 索引標籤。

步驟 5: 在動態頻道指派區段中,於 DCA 頻道區段選取需要的頻道。

步驟 6:在強制執行 PSC 欄位中,按一下切換按鈕,為 DCA 啟用強制使用首選掃描頻道。

#### 步驟7:按一下套用至裝置。

Cor	nfiguration * :	Tags & Profiles * > RF/Radio		Edit RF Profile					
PE	Dartio			General 802.11 RRM	Advanced 802.11ax				
bard ing	+ Add	× Delete		General Coverage TPC	DCA				
	State	P RF Profile Name	▼ Band	Dynamic Channel Assignment					
uration >	0 0	default-rf-profile-6ghz	6 GHz	Avoid AP Foreign AP Interference	Ø				
stration >	0 0	Low_Client_Density_rf_5gh	5 GHz	Channel Width	O 20 MHz O 40 MHz O 80 MHz O 160 MHz				
	0 0	High_Client_Density_rf_5gh	5 GHz		<ul> <li>Best (DBS)</li> </ul>				
ng		Low_Client_Density_rf_24gh	2.4 GHz	D8S Channel Width	Min 20 MHz				
shooting		High_Client_Density_rf_24gh	2.4 GHz	201 00 000					
		Typical_Client_Density_rf_5gh	5 GHz	DCA Channels					
	I	Typical, Client_Density_rf_24gh	2.4 GHz		49         53         57         61         66         69           73         77         81         85         89         93           97         101         105         109         113         117				
Through 3					1/21         1/25         1/29         1/33         1/37         1/41           1/45         1/49         1/53         1/57         1/61         1/155           1/69         1/73         1/37         1/81         1/85         1/89           1/93         1/97         2/01         2/05         2/29         2/33           2/17         2/21         2/25         2/29         2/33				
				PSC Enforcement	ENABLE				
				PSC Channel List	5,21,37,53,69,85,101,117,133,149,165,181,197,213,229				
				1 (1997)					

在 RF 設定檔中設定首選掃描頻道 (CLI)

Device# configure terminal Device(config)# ap dot11 6ghz rf-profile rf-profile-name Device(config-rf-profile)# channel psc

#### 驗證

若要驗證是否已設定完成,請發出以下命令:

<#root>

WLC9800#

show ap rf-profile name default-rf-profile-6ghz detail | b DCA

DCA Channel List : 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69,73,77,81,85,89,93,97,101,105,109, Unused Channel List :

PSC Channel List : 5,21,37,53,69,85,101,117,133,149,165,181,197,213,229

DCA Bandwidth : best DBS Min Channel Width : 20 MHz DBS Max Channel Width : MAX ALLOWED DCA Foreign AP Contribution : Enabled [...]

PSC Enforcement : Enabled

這裡可以看出 Wi-Fi 6E 用戶端只在 PSC 頻道 5 上傳送探查請求:

### NetGear A8000

No. Time Delta	Source	Destination	Protocol	Lengtl Channel	Signal stre	Info				Frame 159500: 360 bytes on wire (2000 bits), 360 bytes captured (2000 bits) on interface \Device\NPF_(D4570905-2998-4456-8C33-C343:
159, 2023-06-09 15:38:48,757226 0.00	0000 Netgear 45:70:_	Cisco 13:00:	802.11	368	5 -47 dbm	Probe Request, SN+0, FN+	-0. Flag	EistC. SSID="wified test"		Ethernet II, Src: Cisco_dd:7d:37 (00:df:1d:dd:7d:37), Ost: Universa_b7:cf:06 (00:3a:88:b7:cf:06)
159, 2023-06-09 15:38:48,759693 0.00	2467 Netgear 48:701_	Cisco 13:00:_	802.11	360	5 -47 dbm	Probe Request, SN=1, FN=F	-0, flag	ESC. SSID-"wified test"		Internet Protocol Version 4, Src: 192.168.1.15, Ost: 192.168.1.121
159. 2023-06-09 15:38:48.781562 0.02	1869 Netgear 48:70:	Cisco 13:80:_	802.11	360	5 -47 d8m	Probe Request, SN+2, FN+F	-0, Flag	ES+C. SSID+"wifi6E test"		User Datagram Protocol, Src Port: 5555, Ost Port: 5000
159. 2023-06-09 15:38:49.009330 0.22	7768 Netgear 48:70:	Cisco 13:80:_	802.11	250	5 -47 d8m	Association Request, SN+	-1. Filed	0. Flags+C. SSID+"wifi68 ter	st"	AiroPeek/OmiPeek encapsulated IEEE 002.11
										802.11 radio information
										IEEE 802.11 Probe Request, Flags:C
									~	ZEEE 802.11 Wireless Management
										<ul> <li>Tagged parameters (270 bytes)</li> </ul>
										✓ Tag: SSID parameter set: "wifi6E_test"
										Tag Number: SSID parameter set (0)
										Teg length: 11
										SSID: "wifi66_test"
										> Tag: Supported Rates 6(0), 9, 12(0), 10, 24(0), 36, 40, 54, [MDIT/Sec]
										> Ext Tag: HE Capabilities
										> Tag: Vendor Specific: Microsoft Corp.: WPS
										> Tag: Vendor Specific: W1-F1 Alliance: Multi Band Operation - Optimized Connectivity Experience
										<ul> <li>Tagi Extended Capabilities (10 offers)</li> </ul>
										ing number: Extended Capabilities (127)
										reg vength: se
										> stende Gpadilite: ewe (otet 1)
										) Extended Capabilities: exwe (octet 2) > Extended Capabilities: exwe (octet 3)
										) Extended Capabilities: even (octet 3)
										> Extended Cambilitation Water (v. v. v. v.)
										> Extended Cambilitation wave (with 2)
										> Extended Capacitation www (week 2)
										<ul> <li>Extended Capabilities: When (octor 7)</li> <li>Extended Capabilities: When (octor 7)</li> </ul>
										<ul> <li>Extended (anabilities: 0x20 (artet 10)</li> </ul>
										0 = Reierved: 0x0
										= THT Requester Support: True
										.e = TwT Responder Support: False
										0 OBSS Narrow Bandwidth RU in UL OFDMA Tolerance Support: False
										Ext Tag: HE Capabilities
										✓ Ext Tag: HE 6 GH: Band Capabilities
										Tag Number: Element ID Extension (255)
										Ext Tag length: 2
										Ext Tag Number: HE 6 GHz Band Capabilities (59)
										> Capabilities Information: 0x36b8
1										

### Pixel 6a

					> Erans 166611 168 hoter on wire /1888 hite) 168 hoter centured /1888 hite) on interfare Ventrals88 Phil/1888.4866.4913.4341
No. Time Deta Source	Destination	Protocox Lengt	channel signalist	re 2/10	Character for disc disc (100 disc) (and (34:31) fits internal bird at (at 1a:00 bird))
126_ 2023-06-09 16:09:25.540710 11.114023 Netgear_40:70:95	Broadcast	802.11 166	5 -44 dbr	Probe Request, SN+1560, FN+0, Flags+C, SSID+"blizzard"	Treferent Protocol Uncolored Corr. 100 120 1 15 Date 100 120 1 101
126. 2023-06-09 16:09:25.549666 0.000956 Netgear_48:70:95	Broadcast	892.11 166	5 -44 004	Probe Request, SN#1561, FN#0, Flags#C, SSID#"Dillziard"	) User Datagram Protocol, Src Port: 5555, Ost Port: 5000
126. 2023-06-09 16109125.550449 0.000783 Netgear_48170195	Broadcast	802.11 166	5 -44 088	Probe Request, SN+1562, PN+0, Plags+C, SSID+"Diliziard"	AiroPeek/OmiPeek encantulated IEEE 802.11
126. 2023-06-09 16:09:25.551320 0.000071 Netgear_48:70:95	Broadcast	802.11 166	5 -44 GBI	Probe Request, SN+1563, PN+0, Plags=C, SSID="Dilling"	has 11 radio information
126. 2023-06-09 16:09:30.176341 4.625021 1/telcor_98:58:07	Broadcast	802.11 168	5 -46 der	Probe Request, SN=1001, FN=0, Flags=C, SSID=Hildcard (8	> ISES BR2.11 Probe Request, Flags:C
126_ 2023-06-09 16:09:30.178573 0.002232 IntelCor_98:58:0f	Broadcast	802.11 168	5 -48 d8r	Probe Request, SN+1002, FN+0, Flags+C, SSID+Hildcard (8	Y TEEL MALE IN A REAL AND A REAL
127_ 2023-06-09 16:09:32.923837 2.745264 IntelCor_98:58:0f	Broadcast	802.11 168	5 -51 dBr	Probe Request, SN+1190, FN+0, Flags+C, SSID+Hildcard (8	V Targed argenters (NA hete)
127_ 2023-06-09 16:09:32.925547 0.001710 IntelCor_98:58:0f	Broadcast	802.11 168	5 -53 dbr	Probe Request, SN+1191, FN+0, Flags+C, SSID+Hildcard (8	V Tap: COTI narawatar (at) "vijice tac"
127_ 2023-06-09 16:09:34.290068 1.364521 IntelCor_98:58:0f	Broadcast	802.11 168	5 -47 der	Probe Request, SN+1200, FN+0, Flags+C, SSID+Hildcard (8	The humber i SID carameter set $(a)$
135. 2023-06-09 16:10:25.522319 51.232251 Netgear_48:70:95	Broadcast	802.11 166	5 -45 der	Probe Request, SN=1694, FN=0, Flags=C, SSID="Dilizard"	Tag length: 11
135. 2023-06-09 16:10:25.522804 0.000485 Netgear_48:70:95	Broadcast	882.11 166	5 -45 der	Probe Request, SN=1695, FN=0, Flags=C, SSID="blizzard"	SSD: "wifild text"
135. 2023-06-09 16:10:25.523726 0.000922 Netgear_40:70:95	Broadcast	802.11 166	5 -45 der	Probe Request, SN+1696, FN+0, Flags+C, SSID+"blizzard"	) Tar: Supported Rates (48), 9, 12(8), 18, 24(8), 36, 48, 54, [Mbit/sec]
135_ 2023-06-09 16:10:25.525359 0.001633 Netgear_48:70:95	Broadcast	002.11 166	5 -45 dbr	Probe Request, SN+1697, FN+0, Flags+C, SSID+"Biliziard"	Y Tar: Extended Supported Bates Side wash to Element Colu. [Bible/Lac]
144_ 2023-06-09 16:11:25.561174 60.035015 Netgear_48:70:95	Broadcast	802.11 166	5 -45 dbr	Probe Request, SN+1828, FN+8, Flags+C, SSID+"01121ard"	Tap lumber: Extended Supported Eates (SD)
144. 2023-06-09 16:11:25.562079 0.000905 Netgear_48:70:95	Broadcast	802.11 166	5 -45 der	Probe Request, SN+1829, PN+0, Flags+C, SSID+"011218rd"	Tag length: 1
144_ 2023-06-09 16:11:25.562892 0.000813 hetgear_48:70:95	Broadcast	882.11 166	5 -45 der	Probe Request, SN+1830, FN+0, Flags+C, SSID+"Dilliard"	Extended Exponented Exter: 546 work to Element (n)v (dwfb)
144_ 2023-06-09 16:11:25.563708 0.000016 Netgear_48:70:95	Broadcast	882.11 166	5 -45 d8r	Probe Request, SN+1831, FN+0, Flags+C, SSID+"blizzard"	Tar Evended Support to Metal Sector (Construction) (Construction)
149_ 2023-06-09 16:11:56.063312 30.499604 IntelCor_98:58:0f	Broadcast	802.11 168	5 -54 dbr	Probe Request, SN+1254, FN+0, Flags+C, SSID+Hildcard (8	Tas for our of the second seco
149_ 2023-06-09 16:11:56.065702 0.002390 IntelCor_98:58:0f	Broadcast	802.11 168	5 -56 dbr	Probe Request, SN+1255, FN+0, Flags+C, SSID+Hildcard (8	V Ext Tax Effe Securit Parameters Indexided
151. 2023-06-09 16:12:07.176171 11.110469 IntelCor_98:58:0f	Broadcast	802.11 168	5 -47 dBr	Probe Request, SN=1316, FN=0, Flags=C, SSID=Hildcard (8	Tak baller blasse for setting (365)
151. 2023-06-09 16:12:07.178494 0.002323 IntelCor_98:58:0f	Broadcast	802.11 168	5 -50 dBr	Probe Request, SN=1317, FN=0, Flags=C, SSID=Hildcard (8	Ext Tay leadth 2
152. 2023-06-09 16:12:15.968792 8.790298 IntelCor_98:58:0f	Broadcast	882.11 168	5 -52 d8r	Probe Request, SN=1380, FN=0, Flags=C, SSID=Hildcard (8	Ever tag sunger: #16 Renuet Rerenters (3)
152_ 2023-06-09 16:12:15.971026 0.002234 IntelCor_98:58:0f	Broadcast	802.11 168	5 -54 d8r	Probe Request, SN+1301, FN+0, Flags+C, SSID+Wildcard (8	End Tag manual i face models for marchine (a)
153_ 2023-06-09 16:12:23.506243 7.535217 IntelCor_98:58:0f	Broadcast	002.11 168	5 -48 d8r	Probe Request, SN+1452, FN+0, Flags+C, SSID+Wildcard (8	EAL 100 VELSE WITT
153_ 2023-06-09 16:12:23.500402 0.002239 IntelCor_90:50:0f	Broadcast	802.11 168	5 -50 dbr	Probe Request, SN+1453, FN+0, Flags+C, SSID+Wildcard (8	<ul> <li>The provide state of the second s</li></ul>
154_ 2023-06-09 16:12:25.504858 1.996376 Netgear_48:70:95	Broadcast	802.11 166	5 -44 dbr	Probe Request, SN+1962, FN+0, Flags+C, SSID+"blizzard"	y for the optimized and the statistics
154_ 2023-06-09 16:12:25.505716 0.000058 Netgear_48:70:95	Broadcast	802.11 166	5 -44 d8r	Probe Request, SN=1963, FN=0, Flags=C, SSID="blizzard"	The subject of Super try System (1981)
154_ 2023-06-09 16:12:25.506499 0.000783 Netgear_48:70:95	Broadcast	802.11 166	5 -45 d8r	Probe Request, SN=1964, FN=0, Flags=C, SSID="blizzard"	Ever Tax Taxathi A
154_ 2023-06-09 16:12:25.507325 0.000026 Netgear_40:70:95	Broadcast	802.11 166	5 -45 d8r	Probe Request, SN=1965, FN=0, Flags=C, SSID="blizzard"	Ext ing serger 2 for fand fanabilitian (64)
154_ 2023-06-09 16:12:26.610079 1.110754 IntelCor_90:50:0f	Broadcast	002.11 168	5 -52 dBr	Probe Request, SN+1524, FN+0, Flags+C, SSID+Wildcard (8	Et ing manuti ne b vis bond uppersations (37)
154_ 2023-06-09 16:12:26.619626 0.001547 IntelCor_98:58:0f	Broadcast	802.11 168	5 -54 dbr	Probe Request, SN+1525, FN+0, Flags+C, SSID+Wildcard (8	- coperation and a minimum inter tract teaction a -t (aut)
155. 2023-06-09 16:12:29.700626 3.009000 IntelCor_98:58:0f	Broadcast	802.11 168	5 -46 dBr	Probe Request, SN+1586, FN+0, Flags+C, SSID+Wildcard (8	11 1 - Barland Food July 2 - Start Events (Art)
155_ 2023-06-09 16:12:29.715971 0.007345 IntelCor_98:58:0f	Broadcast	882.11 168	5 -49 d8r	Probe Request, SN=1587, FN=0, Flags=C, SSID=Wildcard (8	the state of the s
156_ 2023-06-09 16:12:32.994784 3.278813 IntelCor_98:58:0f	Broadcast	802.11 168	5 -51 d8r	Probe Request, SN+1652, FN+0, Flags+C, SSID+Wildcard (8	
156_ 2023-06-09 16:12:32.997156 0.002372 IntelCor_98:58:0f	Broadcast	802.11 168	5 -54 der	Probe Request, SN+1653, FN+0, Flags+C, SSID+Wildcard (8	
157_ 2023-06-09 16:12:37.063162 4.066006 IntelCor_98:58:0f	Broadcast	002.11 168	5 -46 der	Probe Request, SN+1694, FN+0, Flags+C, SSID+Hildcard (8	
163. 2023-06-09 16:13:19.734428 42.671266 82:e0:e2:d5:82:ee	Broadcast	802.11 132	5 -39 dBr	Probe Request, SN=494, FN=0, Flags=C, SSID="wifi6E_test	The second secon
164_ 2023-06-09 16:13:25.523210 5.788782 Netgear_48:70:95	Broadcast	802.11 166	5 -45 dBr	Probe Request, SN=2096, FN=0, Flags=C, SSID="blizzard"	A The Antenne Pattern Consistency and Supported
164_ 2023-06-09 16:13:25.523982 0.000772 Netgear_48:70:95	Broadcast	802.11 166	5 -45 d8r	Probe Request, SN=2097, FN=0, Flags=C, SSID="blizzard"	and a statement with a statement with
164_ 2023-06-09 16:13:25.524998 0.001016 Netgear_48:70:95	Broadcast	802.11 166	5 -45 d8r	Probe Request, SN=2098, FN=0, Flags=C, SSID="blizzard"	Were three the set of the
164_ 2023-06-09 16:13:25.526167 0.001169 Netgear_48:70:95	Broadcast	802.11 166	5 -45 d8r	Probe Request, SN+2099, FN+0, Flags+C, SSID+"blizzard"	The lamber of states to System (165)
165_ 2023-06-09 16:13:32.557265 7.031098 Google_72:88:66	Broadcast	802.11 350	5 -38 dBr	Probe Request, SN+13, FN+0, Flags+C, SSID+"wifi6E_test"	Full Tax Taxathi 4
181. 2023-06-09 16:13:52.470230 19.912965 Google_72:88:66	Broadcast	802.11 135	5 -45 dBr	Probe Request, SN+206, FN+0, Flags+C, SSID+*wifi6E_test	The reg structure reaction of the second state
187_ 2023-06-09 16:14:05.067397 12.597167 IntelCor_98:58:0f	Broadcast	802.11 168	5 -50 dbr	Probe Request, SN+1749, FN+0, Flags+C, SSID+Wildcard (8	EAS THE PRIMARY A MARY ANALY (TH)
187_ 2023-06-09 16:14:05.069615 0.002218 IntelCor_98:58:0f	Broadcast	802.11 168	5 -53 dBr	Probe Request, SN=1750, FN=0, Flags=C, SSID=Wildcard (8	A that wanter function in the model from a solid
191. 2023-06-09 16:14:25.554976 20.485361 Netgear_48:70:95	Broadcast	802.11 166	5 -45 d8r	Probe Request, SN=2230, FN=0, Flags=C, SSID="blizzard"	7 registered apextaxis reactives on put was by Tast successful and the apextaxis of the successful approximate
191. 2023-06-09 16:14:25.555590 0.000614 Netgear_48:70:95	Broadcast	802.11 166	5 -45 der	Probe Request, SN=2231, FN=0, Flags=C, SSID="blizzard"	2 100 Tart Mode Constitute 11 111 Annual 1 & Englishing
191_ 2023-06-09 16:14:25.556509 0.000919 Netgear_45:70:95	Broadcast	802.11 166	5 -45 dBr	Probe Request, SN+2232, FN+0, Flags+C, SSID+"blizzard"	2 ing. these spectral marks calendar, proper an analytical b Take backs for differ birought for a lubrand back a
191. 2023-06-09 16:14:25.557345 0.000036 Netgear_48:70:95	Broadcast	802.11 166	5 -45 dBr	Probe Request, SN+2233, FN+0, Flags+C, SSID+"blizzard"	2 Ing. These appears in an open surply without a b Task backs face (first faceback)
192. 2023-06-09 16:14:26.967711 1.410366 IntelCor_90:58:0f	Broadcast	802.11 168	5 -47 d8r	Probe Request, SN+1817, FN+0, Flags+C, SSID+Wildcard (8	> Tag: takes spectra, in tensor > Tag: weder fact differ of alliance: milti mad concention - optimized concertivity invariance
192_ 2023-06-09 16:14:26.970276 0.002565 IntelCor 98:58:0f	Broadcast	802.11 168	5 -49 d8r	Probe Request, SN+1818, FN+0, Flags+C, SSID+Wildcard (8	2 reg. minor spectral mars statement mark were operated - optimized connectivity inperience

## Samsung S23

No.	Time	0	elta	Source	Destination	Protocol	Lengti Channel	Signal stre	Info				> Frame 65924: 164 Dytes on kire (1312 Dits), 164 Dytes captured (1312 Dits) on interface (Device(NPF_(D4578965-2998-4A56-BC33-CD4316
	620 2023-06-09	16:02:25.542609	0.000000	Netgear_48:70:95	Broadcast	802.11	166	5 -45 dbm	Probe Request, SN+62	2, FN+0,	Flags+C, SSID+"blizza	"b"	> Ethernet II, Src: Cisco_dd:7d:37 (00:df:1d:dd?d:37), Ost: Universa_D7:cf:06 (00:3a:88:b7:cf:06)
	621 2023-06-09	16102125.543382	0.000773	Netgear_48:70:95	Broadcast	802.11	166	5 -45 dbm	Probe Request, SN+63	3, FN=0,	FlagsC. SSID-"blizza	rd"	> Internet Protocol Version 4, Src: 192.168.1.15, Dst: 192.168.1.121
	622 2023-06-09	16:02:25.544166	0.000754	Netgear_48:70:95	Broadcast	802.11	166	5 -45 d8m	Probe Request, SN=63	4, FN=0,	FlagsC. SSID-"blizza	"d"	> User Datagram Protocol, Src Port: 5555, Dst Port: 5000
	624 2023-06-09	16:02:25.545262	0.001096	Netgear 48:70:95	Broadcast	882.11	166	5 -45 dim	Probe Request, SN+63	5. FN+0.	Flagte	"d"	> AiroPeek/OmiPeek encapsulated IEEE 802.11
	9421 2023-06-09	16:02:47.759164 2	2.211982	IntelCor servered	Broadcast	882.11	168	5 .44 dbs	Probe Request, SNa11	1. EN+0.	Flagta	1 (800	> 802.11 radio information
	9422 2023-06-09	16102147.761269	0.002105	IntelCor saissiaf	Broadcast	882.11	168	5 .46 .000	Prohe Request, SNa11	2. EN#0.	flagts	1 CRON	> IEEE 802.11 Probe Request, Flags:C
	128 2023-06-05	16:02:51 445605	3 684339	Total/or Stiffield	Broadcast	882.11	168	5 .57 .000	Broke Request, 55-34	5. 53-0	Flatte C SSTD-wildcar	1 (800	✓ IEEE 002.11 Wireless Management
	120. 2013-00-07	16-02-51 447005		Tetal/or second	Repadract		160	E .Ed dila	Broke Request, Stabl		flage / filler	1 (800	<ul> <li>Tagged parameters (74 bytes)</li> </ul>
	116 1013 06 00	16-03-36 646688 3	4 447784	Natana 40.70.05	Repadcast	000.11	166	5 43 484	Broke Remark Ch. 70	6 51-0	flagt / fflb.7bliste	10101	> Tag: SSID parameter set: wildcard SSID
	C45. 2023-00-07	101031231345587 3		nerfeat "wertaraa	Brobblest	004.44	100	5 147 668	Prove Request, Surry	a, rang,	fings		> Tag: Supported Rates 6, 9, 12, 18, 24, 36, 48, 54, [Mbit/sec]
	225 2023-06-09	16:03:25.545589	e.000000	netgear_40:70:99	Broadcast	802.11	166	5 -47 cen	Probe Request, SN+7	7, Phiet,	Fings	0	Tag: Extended (apabilities (11 octets))
	226 2023-06-09	16:03:25.545589	e.000000	vergear_4s:/e:ys	erosocast	802.11	100	5 -40 CUM	Probe Request, SN#/1	a, rawe,	+18g1+, 5510+ 011228	0	Tar Number: Extended Carabilities (127)
	226 2023-06-09	16103125-545589	0.000000	netgear_401/0195	Broadcast	002.11	100	5 -4/ 008	Probe Request, SN#/1	a, man,	*18gs+, 5510+ 011228	0	Tag length: 11
	414_ 2023-06-09	16104102.310242 3	6.764653	IntelCor_98158107	Broadcast	802.11	168	5 -44 008	Probe Request, SN+40	9, 18+0,	Fings+C, SSID+HildCar	a Ceuci	> Extended Canabilities: Eves (octet 1)
	414. 2023-06-09	16104102.312552	0.002310	10/fercor_asizates	Broadcast	802.11	168	5 -47 088	Probe Request, Study	0, 1840,	Flags=C, SSID=H110Car	a (ero	Extended Canabilities: 0x00 (octet 3)
	422., 2023-06-09	16:04:05.183773	2.871221	IntelCor_98:58:0f	Broadcast	802.11	168	5 -55 d8n	Probe Request, SN+5)	4, FN+0,	Flags+C, SSID+Wildcar	1 (Broi	) Extended Cambinities: When (where 1)
	422 2023-06-09	16:04:05.186047	0.002274	IntelCor_98:58:0f	Broadcast	802.11	168	5 -57 dên	Probe Request, SN+5)	5, FN+0,	FlagiC, SSID-Wildcar	(ero	<ul> <li>Evtended Campbellitter: Wells (with 4)</li> </ul>
	481. 2023-06-09	16:04:25.622592 2	0.436545	Netgear_48:70:95	Broadcast	802.11	166	5 -46 don	Probe Request, SN+85	0, Flieb,	Flagi+C, 551D+"011228	nd"	Extended Competitives and (extent %)
	481. 2023-06-09	16:04:25.623258	0.000000	Netgear_48:70:95	Broadcast	802.11	166	5 -47 dbm	Probe Request, SN+85	1, FN+0,	Flags+C, SSID+"Blizza	rd"	> Extended computations and (other 5)
	481. 2023-06-09	16:04:25.624360	0.001102	1 Netgear_48:70:95	Broadcast	802.11	166	5 -47 d8m	Probe Request, SN+85	2, FN+0,	Flags+C, SSID+"Blizza	nd"	> Extended Capabilities: extended ab
	481. 2023-06-09	16:04:25.624869	0.000509	Netgear_48:70:95	Broadcast	802.11	166	5 -46 d8m	Probe Request, SN+85	3, FN=0,	Flags=C, SSID="blizza	rd"	<pre>&gt; Extended Capabilities: exe (otet /)</pre>
	481., 2023-06-09	16:04:25.885143	0.260274	IntelCor_98:58:0f	Broadcast	802.11	168	5 -47 d8m	Probe Request, SN+53	8, FN=0,	Flags=C, SSID=Wildcar	d (Bro	> Extended Capabilities: 0x8040 (ottets 8 8 9)
	659 2023-06-09	16:05:19.040282 5	3.155139	SamsungE_c9:e3:71	Broadcast	802.11	172	5 -60 d0m	Probe Request, SN+11	1, FNie0,	Flags+C, 551D+80		<ul> <li>Extended Capabilities: ex21 (octet 10)</li> </ul>
	659. 2023-06-09	16:05:19.041579	0.001297	SamsungE_C9:e3:71	Broadcast	802.11	164	5 -60 don	Probe Request, SN+11	2, FN=0,	FlagiaC, SSID-Wildcar	(Brok	+ FILS Capable: True
	659. 2023-06-09	16:05:19.042891	0.001312	SansungE_C9:e3:71	Broadcast	802.11	164	5 -60 dbm	Probe Request, SN+11	3, FN+0,	Flags+C, SSID-Wildcar	t (Broi	
	659., 2023-06-09	16:05:19.044213	0.001322	SansungE_c91e3171	Broadcast	802.11	164	5 -60 dbn	Probe Request, SN+13	4, FN=0,	Flags+C, SSID+Wildcar	t (Brow	0 = Future Channel Capable: False
	659. 2023-06-09	16:05:19.060095	0.015882	SamsungE_c9:e3:71	Broadcast	802.11	172	5 -59 d8m	Probe Request, SN+13	S, FN=0,	Flags+C, SSID+80		0 = Reserved: 0x0
	659. 2023-06-09	16:05:19.060913	0.000515	SamsungE_c9:e3:71	Broadcast	802.11	164	5 -61 d8m	Probe Request, SN+13	6, FN+0,	FlagsC, SSID-Wildcar	d (Bro	0 * Reserved: 0x0
	659. 2023-06-09	16:05:19.061998	0.001005	SamsungE c9:e3:71	Broadcast	802.11	164	5 -61 d0m	Probe Request, SN+11	7. FN+0.	Flags+C. SSID+Wildcar	d (Bro	This Requester Support: True
	(59., 2023-06-09	16:05:19,063030	0.001032	Samsungt (9:e3:71	Broadcast	002.11	164	5 -61 d0m	Probe Request, SN+11	G. FN+0.	FlagsC. SSID-Wildcar	t (ero	.0 = TwT Responder Support: False
	670. 2023-06-09	16:05:23.619198	4,556168	IntelCor 98:55:0f	Broadcast	882.11	168	5 -51 008	Probe Request, SN+63	5, FN+0,	flagsC. SSID-Wildcar	t Cerev	e + OBSS Narrow Bandwidth RU in UL OFDMA Tolerance Support: False
	670. 2023-06-09	16:05:23.621437	0.002239	IntelCor 98:53:64	Broadcast	882.11	168	5 .54 dbs	Probe Request, SN=61	6. FN=0.	FlagtaC. SSID-Hildcar	t Citros	> Extended Capabilities: ex20 (octet 11)
	672. 2023-06-09	16:05:25.530364	1,908927	Netgear 48:70:95	Broadcast	882.11	166	5 -47 dim	Probe Request, SN+16	24. FN+0.	Flagte	and"	> Tag: Vendor Specific: Microsoft Corp.: Unknown 8
	672. 2023-06-09	16:05:25.532117	0.001753	Netgear 48:70:95	Broadcast	882.11	166	5 -47 dim	Probe Request, SN+16	25. FN+0.	Flagte	and"	✓ Ext Tag: HE Capabilities
	672 2021-06-09	16:05:25.512117	0.000000	Netwar 48-78-95	Broadcast	882.11	166	5 .47 /04	Probe Request, Shall	26 EN+0	Elanta C. SSIDa "Alire	red"	Tag Number: Element 1D Extension (255)
	172 2023-06-09	16:05:25.532841	0.000724	Netwar 48:78:95	Broadcast	882.11	166	5 .47 (88	Prohe Benuest, Shall	27. EN+0	Electer	end"	Ext Tag length: 32
	(87. 2023-06-09	16105132.250692	6.717851	Santunge (Stell/21	Broadcast	882.11	172	5 .66 088	Prohe Bequest, Shall	7. ENall.	flars		Ext Tag Number: HE Capabilities (35)
	107 2022-06-00	16-06-33 361665		Samural chialing	Broadcast	883 11	164	5 .64 /84	Broke Request Studie	0. 51-0	Elasta / SETD-utildran	1.7800	> HE MAC Capabilities Information: 0x0040da10010f
	107 3033-06-09	16-05-33 153934	8 8811773	Campione coral-11	Broadcast	882 11	164	5 .64 /04	Broke Banuart Ch.10	0 51-0	Elasta / SCID-uildran	1 (800	> HE PHY Capabilities Information
	LET 2011-0C-05	16-06-33 364316	8 881282	Campunge_Corest-71	Broadcast	682.11	164	5 .64 404	Prohe Desugate Chult	0 51-0	Elant, / SSTD-Wildram	1 (800	> Supported HE-MCS and NSS Set
	107. 2023-00-07	10.00.33 338000		Francisco Constants	Repaired	002.11	177	F 64 684	Books Requests First		flage C FFTD-50	1.01.01	> PPE Thresholds
	107. 2023-00-07	10:09:32.270004		Sansungs_C9103171	Broadcast	882.11	1/2	5 -64 000	Probe Request, SHALL	2, 7000,	Flags	1.000	Ext Tag: HE 6 GHZ Band Capabilities
	107. 2023-00-07	10:05:32.2/1900	0.001242	famoungs_creation	Broadcast	002.11	164	5 -65 000	Probe Request, SN410	ic, rand,	flags ( fith-uildear	d (Bee	Tag Number: Element ID Extension (255)
	007	101001341473040	0.001134	sensurge_catest/x	Broaucast	002.11	104	5 -66 000	Probe Request, SN+10	o, rang,	fingsentition, someninger	( CONTRACT	Ext Teg length: 2
	687. 2023-06-09	16:05:32.274021	0.000981	Sansunge_c9:e3:71	Broadcast	802.11	164	5 -66 088	Probe Request, SN+10	a, rase,	F18g5*	Caros	Ext Tag Number: HE 6 GHz Band Capabilities (59)
	687 2823-06-49	16:05:32.391673	0.11/652	Sauroude_catestize	Broadcast	802.11	106	5 -66 CBR	Probe Request, State	o, raw,	stagss	12244	<ul> <li>Gaubilities Information: dubibd</li> </ul>
	/04. 2023-06-09	10:09:49.259330 1	2.007657	Sansungs_c9:e3:71	erosocást	802.11	1/2	5 -64 don	Probe Request, SN+10	a, rhat,	*18g3*C, 551D+80		101 - Minimum MPCu Start Scaring: 4 uS (8x5)
	704 2023-06-09	16:05:45.260176	0.000546	Samsungs_c9:e3:71	Broadcast	002.11	164	5 -65 dön	Probe Request, SN+10	5, FN+0,	Flags+C, SSID+Wildcar	a (ero	
	704. 2023-06-09	16:05:45.261017	e.ee0541	Samsungt_c91e3171	Broadcast	802.11	164	5 -66 008	Probe Request, SN+10	6, FN+0,	Fiegs+C, SSID+Hildcer	3 (84.64	18 Maximum MPCk Length: 11 454 (8x2)
	704. 2023-06-09	16105145.261948	e.ee0931	Samsunge_c91e3171	Broadcast	802.11	164	5 -65 088	Probe Request, SN+10	7, 75+0,	Fings+C, SSID+Hildcar	3 (84.01	a peterval ava
	705 2023-06-09	16105145.280295	0.018347	SamsungE_C91e3171	Broadcast	862.11	1/2	5 -64 dên	Probe Request, SN+10	8, FN=0,	Piegs+C, SSID+80		11
	705 2023-06-09	16:05:45.281598	0.001303	SamsungE_c9:e3:71	Broadcast	802.11	164	5 -64 d8n	Probe Request, SN+10	9, FN+0,	Flags+C, SSID+Wildcar	(Bro	A
	705 2023-06-09	16:05:45.283210	0.001612	SamsungE_c9:e3:71	Broadcast	802.11	164	5 -64 d0n	Probe Request, SN+15	0, FN+0,	FlagisC, SSID-Wildcar	(ero	Dr Interne Butterne Constituterus Sat supported
	705 2023-06-09	16:05:45.284052	0.000842	SamsungE_C9:e3:71	Broadcast	802.11	164	5 -65 dbm	Probe Request, SN+15	1, FN+0,	Flags+C, SSID+Wildcar	s (ero	A - Ty internet Reflecting Constitutions, and Support the
													etc
													NAMES AND ADDRESS OF A DRESS ADDRESS ADDRE

#### Intel AX211



6-GHz 用戶端導向

相較於 2.4-GHz 和 5-GHz 頻帶,6-GHz 頻帶的頻道更多、頻寬更大,而且網路壅塞情形較少。

因此,支援 6-GHz 的無線用戶端可連線 6-GHz 無線電,以善用上述優點。

本主題詳細說明 AP 在支援 6-GHz 頻帶下的 6-GHz 用戶端導向功能。

控制器從 2.4-GHz 頻帶或 5-GHz 頻帶收到定期用戶端統計報告時,就會執行 6-GHz 用戶端導向。

用戶端導向設定需在 WLAN 下啟用,且設定只適用於支援 6-GHz 的用戶端。

如果報告中的用戶端支援 6-GHz,就會觸發用戶端導向,將用戶端導向 6-GHz 頻帶。

請參閱 Qualcomm 研究報告《雙頻 Wi-Fi 存取點的頻帶導向》文件中的「雙頻 Wi-Fi 存取點的頻帶 導向」。

導向機制

若要開始將用戶端導向,AP 首先須與特定頻帶上的用戶端解除關聯,然後阻止該用戶端與該頻帶 建立關聯一段時間。 解除關聯後,用戶端會先短暫嘗試與上一個關聯的相同 SSID 和頻帶上的 AP 建立關聯,然後才掃 描其他 AP 或頻帶選項。

大部分 Wi-Fi 用戶端會傳送探查請求並從探查回應預估下行鏈路訊號強度,藉此同時掃描兩個頻段 ,而探查回應也會指出 AP 是否已準備好重新建立關聯。

由於這種掃描和重新關聯的行為完全取決於用戶端實作,因此每個用戶端的導向速度都不一樣。

部分用戶端可能不會導向,而是持續嘗試重新與原(已封鎖)頻帶建立關聯,或直接選擇與 Wi-Fi 完全解除關聯,只有在需傳送封包時嘗試重新關聯。

導向注意事項

請特別留意 AP 的情況,防止可能不會導向的用戶端在 AP 遭到封鎖,若發生此情形,可能需要使 用者介入,才能恢復 Wi-Fi 連線。

最簡單的使用者介入操作是開啟/關閉 Wi-Fi。顯然這種使用者介入方式並不理想,因此設計偏向保 守。

如果用戶端無法導向或嘗試導向失敗,AP 會讓用戶端重新建立與原頻帶的關聯,避免用戶端遭 AP 長時間封鎖的風險。

由於用戶端只會在閒置時導向,因此不會中斷使用者流量。

在全域設定模式 (GUI) 下設定 6-GHz 用戶端導向

步驟1:選擇「設定」>「無線」>「進階」。

步驟 2:按一下 6 GHz 用戶端導向索引標籤。用戶端導向需針對每個 WLAN 分別設定。

步驟 3:在 6 GHz 轉換用戶端數下限欄位中輸入值,以設定用戶端導向所需的最少用戶端數量。預 設值為三個用戶端。值的範圍介於 0 到 200 個用戶端。

步驟 4:在 6 GHz 轉換視窗大小下限欄位中輸入值,以設定用戶端導向所需的最小視窗大小。預設 值為三個用戶端。值的範圍介於 0 到 200 個用戶端。

步驟 5:在 6 GHz 轉換使用率差異上限欄位中輸入值,以設定用戶端導向所需的轉換使用率差異上限。值的範圍介於 0% 到 100%。預設值為 20。

步驟 6:在 6 GHz 轉換 2.4 GHz RSSI 臨界值下限欄位中輸入值,以設定用戶端導向的最小 2.4-GHz RSSI 臨界值。

步驟 7:在 6 GHz 轉換 5 GHz RSSI 臨界值下限欄位中輸入值,以設定用戶端導向的最小 5-GHz RSSI 臨界值。

步驟8:按一下套用。



在全域設定模式下設定 6-GHz 用戶端導向 (CLI)

```
Device# configure terminal
Device(config)# client-steering client-count 3
Device(config)# client-steering window-size 5
Device(config)# wireless client client-steering util-threshold 25
Device(config)# wireless client client-steering min-rssi-24ghz -70
Device(config)# wireless client client-steering min-rssi-5ghz -75
```

在 WLAN 上設定 6-GHz 用戶端導向 (GUI)

步驟 1:選擇「設定」>「標籤和設定檔」>「WLAN」。 步驟 2:按一下「新增」。「新增 WLAN」頁面會隨即顯示。 步驟 3:按一下進階索引標籤。 步驟 4:勾選 6 GHz 用戶端導向核取方塊,在 WLAN 上啟用用戶端導向。 步驟 5:按一下套用至裝置。

earch Menu liems	Configuration -> Tags & Profiles -> WLANs		Edit WLAN				
ashboard	+ Add X Delete	Enable WLAN	Changing WLAN pa	rameters while it is enabled will	result in loss of connectivi	ity for clients connec	ted to it.
Ionitoring	Selected WLANs : 0		General Security Adva	nced Add To Policy Ta	gs		
	O Status T Name	Υ D	Coverage Hole Detection	Ø	Universal Admin	0	
onfiguration	> o o	N 1	ourouge role enteren	-	on the set of the set	-	
Iministration	, O O esteres	• 2	Aironet IE O	U	OKC	U	
	0 0	<ul> <li>3</li> </ul>	Advertise AP Name	0	Load Balance	0	
ensing	0 0	<b>*</b> 4	P2P Blocking Action	Disabled +	Band Select	0	
subleshooting	witte_test	. 5	Multicast Buffer	DISABLED	IP Source Guard	O	
	withoE_test_02	• 7	Media Stream Multionet dimet		WMM Policy	Allowed	•
	····		11ac MU-MIMO	0	mDNS Mode	Bridging	•
alk Me Theough i			WIFI to Cellular Steering	o	Off Channel Scanni	ing Defer	
			Fastiane+ (ASR) 0	٥			
			Deny LAA (RCM) clients	0	Deter Priority	<b>O</b> o <b>O</b> 1	<b>D</b> 2
			6 GHz Client Steering	0		03 04	Ø 5
			Max Client Connections			U6 U7	
					Scan Defer Time	100	
			Per WLAN	0	Assisted Roaming (	(11k)	
			Per AP Per WLAN	0			
			Dec 10 Decision Dec 100 Million		Prediction Optimizatio	on O	
			Per AP Radio Per WLAN	200	Noighbor List.	Ø	
			11v BSS Transition Support		Dual Band Neighbor I	List O	

#### 在 WLAN 上設定 6-GHz 用戶端導向 (CLI)

Device# configure terminal Device(config)# wlan wlan-name *id ssid-name* Device(config-wlan)# client-steering

#### 驗證

若要驗證是否已設定完成,請發出以下命令:

<#root>

WLC9800#

show wireless client steering

Client Steering Configuration Information Macro to micro transition threshold : -55 dBm Micro to Macro transition threshold : -65 dBm Micro-Macro transition minimum client count : 3 Micro-Macro transition client balancing window : 3 Probe suppression mode : Disabled Probe suppression transition aggressiveness : 3 Probe suppression hysteresis : -6 dB 6Chz transition minimum client count : 3 6Chz transition minimum window size : 3 6Chz transition maximum channel util difference : 20% 6Chz transition minimum 2.4Chz RSSI threshold : -60 dBm 6Chz transition minimum 5Chz RSSI threshold : -65 dBm

WLAN Configuration Information

WLAN Profile Name 11k Neighbor Report 11v BSS Transition

5	wifi6E_test	Enabled	Enabled
6	wifi6E_test_01	Enabled	Enabled
7	wifi6E_test_02	Enabled	Enabled

WLC9800#

show wlan id 5 | i Client Steering

6Ghz Client Steering : Enabled

用戶端連線

本節說明每個用戶端連線 WLAN 的 OTA 程序。

實驗室具備以下條件:

- 用戶端和 AP 直線距離約 1 公尺,中間無障礙物。
- 所有 AP 都是以頻寬 160MHz 和功率位準 1 的 WLAN 廣播。
- 用戶端裝置在與 iPerf 伺服器相同的 VLAN 上開啟。
- 所有 AP 都透過 1 Gbps 鏈結連線。

# 6 GHz Radios Total 6 GHz radios : 4

AP Name	÷	Slot No	÷	Base Radio MAC	Admin Status	1	Operation : Status	Policy Tag 🗼	1	Site Tag	:	RF Tag	i	Channel Width	Channel	:	Power Level 0	
AP9166_0E.6220	1	2		7411.b2d2.9740	0		0	Wifi6E_TestPolicy		TiagoHomePTAPs		default-rf-tag		160 MHz	(69,65,73,77,81,85,89,93)	•	*1/8 (19 dBm)	
AP9162_53.CA50		2		3891.b713.80e0	0		0	Wifi6E_TestPolicy		TiagoHomePTAPs		default-rf-tag		160 MHz	(5,1,9,13,17,21,25,29)*		*1/8 (17 dBm)	
AP9136_5C.F524	Let	3		00df.1ddd.7d30	0		0	Wih6E_TestPolicy		TiagoHomePTAPs		default-rf-tag		160 MHz	(53,49,57,61,33,37,41,45)*	•	*1/8 (16 dBm)	

#### 透過 AP 9166 測試

#### NetGear A8000

WLC 用戶端詳細資訊:

#### <#root>

#show wireless client mac-address 9418.6548.7095 detail

Client MAC Address : 9418.6548.7095 [...] Client IPv4 Address : 192.168.1.163 [...] AP MAC Address : 7411.b2d2.9740 AP Name: AP9166\_0E.6220 AP slot : 2 Client State : Associated Policy Profile : Policy4TiagoHome Flex Profile : TiagoHomeFlexProfile Wireless LAN Id: 5 WLAN Profile Name: wifi6E\_test Wireless LAN Network Name (SSID): wifi6E\_test BSSID : 7411.b2d2.9747 Connected For : 1207 seconds

Protocol : 802.11ax - 6 GHz

Channel : 69

[...]
Current Rate : m11 ss2
Supported Rates : 54.0
[...]

Policy Type : WPA3

Encryption Cipher : CCMP (AES)

SAE PWE Method : Hash to Element(H2E) [...] Protected Management Frame - 802.11w : Yes EAP Type : Not Applicable [...] [...] FlexConnect Data Switching : Local FlexConnect Dhcp Status : Local FlexConnect Authentication : Local Client Statistics: Number of Bytes Received from Client : 1026751751 Number of Bytes Sent to Client : 106125429 Number of Packets Received from Client : 793074 Number of Packets Sent to Client : 184944 Number of Policy Errors : 0 Radio Signal Strength Indicator : -44 dBm Signal to Noise Ratio : 49 dB [...] Device Classification Information: Device Type : Microsoft-Workstation Device Name : CSCO-W-xxxxxxx Protocol Map : 0x000029 (OUI, DHCP, HTTP) Device OS : Windows NT 10.0; Win64; x64 Pixel 6a WLC 用戶端詳細資訊: <#root> #show wireless client mac-address 2495.2f72.8a66 detail Client MAC Address : 2495.2f72.8a66 [...] Client IPv4 Address : 192.168.1.162 [...] AP MAC Address : 7411.b2d2.9740 AP Name: AP9166\_0E.6220 AP slot : 2

AAA override passphrase : No

Client State : Associated Policy Profile : Policy4TiagoHome Flex Profile : TiagoHomeFlexProfile Wireless LAN Id: 5 WLAN Profile Name: wifi6E\_test Wireless LAN Network Name (SSID): wifi6E\_test BSSID : 7411.b2d2.9747 Connected For : 329 seconds Protocol : 802.11ax - 6 GHz Channel : 69 Client IIF-ID : 0xa000000a Association Id : 33 Authentication Algorithm : Open System [...] Current Rate : 6.0 Supported Rates : 61.0 [...] Policy Type : WPA3 Encryption Cipher : CCMP (AES) Authentication Key Management : SAE AAA override passphrase : No SAE PWE Method : Hash to Element(H2E) [...] Protected Management Frame - 802.11w : Yes EAP Type : Not Applicable [...] Session Manager: Point of Attachment : capwap\_90000025 IIF ID : 0x9000025 Authorized : TRUE Session timeout : 86400 Common Session ID: 0000000000171BC51FF477 Acct Session ID : 0x0000000 Auth Method Status List Method : SAE Local Policies: Service Template : wlan\_svc\_Policy4TiagoHome (priority 254) VLAN : default Absolute-Timer : 86400 Server Policies: **Resultant Policies:** VLAN Name : default VLAN : 1Absolute-Timer : 86400 [...] FlexConnect Data Switching : Local FlexConnect Dhcp Status : Local

FlexConnect Authentication : Local Client Statistics: Number of Bytes Received from Client : 603220312 Number of Bytes Sent to Client : 72111916 Number of Packets Received from Client : 461422 Number of Packets Sent to Client : 107888 Number of Policy Errors : 0 Radio Signal Strength Indicator : -45 dBm Signal to Noise Ratio : 48 dB [...] Device Classification Information: Device Type : Android-Google-Pixel Device Name : Pixel-6a Protocol Map : 0x000029 (OUI, DHCP, HTTP) Device OS : X11; Linux x86\_64 Samsung S23 WLC 用戶端詳細資訊: <#root>

Client MAC Address : 0429.2ec9.e371 [...] Client IPv4 Address : 192.168.1.160 [...] AP MAC Address : 7411.b2d2.9740 AP Name: AP9166\_0E.6220 AP slot : 2 Client State : Associated Policy Profile : Policy4TiagoHome Flex Profile : TiagoHomeFlexProfile Wireless LAN Id: 5 WLAN Profile Name: wifi6E\_test Wireless LAN Network Name (SSID): wifi6E\_test BSSID : 7411.b2d2.9747 Connected For : 117 seconds Protocol : 802.11ax - 6 GHz

#show wireless client mac-address 0429.2ec9.e371 detail

Channel : 69

Client IIF-ID : 0xa0000002 Association Id : 33

```
Authentication Algorithm : Open System
[...]
Current Rate : 6.0
Supported Rates : 54.0
[...]
Policy Type : WPA3
Encryption Cipher : CCMP (AES)
Authentication Key Management : SAE
AAA override passphrase : No
SAE PWE Method : Hash to Element(H2E)
[...]
Protected Management Frame - 802.11w : Yes
EAP Type : Not Applicable
[...]
Session Manager:
Point of Attachment : capwap_90000025
IIF ID : 0x90000025
Authorized : TRUE
Session timeout : 86400
Common Session ID: 00000000001713C518E305
Acct Session ID : 0x0000000
Auth Method Status List
Method : SAE
Local Policies:
Service Template : wlan_svc_Policy4TiagoHome (priority 254)
VLAN : default
Absolute-Timer : 86400
Server Policies:
Resultant Policies:
VLAN Name : default
VLAN : 1
Absolute-Timer : 86400
[...]
FlexConnect Data Switching : Local
FlexConnect Dhcp Status : Local
FlexConnect Authentication : Local
Client Statistics:
Number of Bytes Received from Client : 550161686
Number of Bytes Sent to Client : 5751483
Number of Packets Received from Client : 417388
Number of Packets Sent to Client : 63427
Number of Policy Errors : 0
Radio Signal Strength Indicator : -52 dBm
```

```
Signal to Noise Ratio : 41 dB
```

[...] Device Classification Information:

Device Type : Android-Device

Device Name : Galaxy-S23

Protocol Map : 0x000029 (OUI, DHCP, HTTP)

Intel AX211

WLC 用戶端詳細資訊:

#### <#root>

#show wireless client mac-address 286b.3598.580f detail Client MAC Address : 286b.3598.580f [...] Client IPv4 Address : 192.168.1.159 [...] AP MAC Address : 7411.b2d2.9740 AP Name: AP9166\_0E.6220 AP slot : 2 Client State : Associated Policy Profile : Policy4TiagoHome Flex Profile : TiagoHomeFlexProfile Wireless LAN Id: 5 WLAN Profile Name: wifi6E\_test Wireless LAN Network Name (SSID): wifi6E\_test BSSID : 7411.b2d2.9747 Connected For : 145 seconds Protocol : 802.11ax - 6 GHz Channel : 69 Client IIF-ID : 0xa0000001 Association Id : 35 Authentication Algorithm : Open System [...] Current Rate : 6.0 Supported Rates : 54.0 AAA QoS Rate Limit Parameters: QoS Average Data Rate Upstream : (kbps) QoS Realtime Average Data Rate Upstream : (kbps) QoS Burst Data Rate Upstream : (kbps) QoS Realtime Burst Data Rate Upstream : (kbps) QoS Average Data Rate Downstream : (kbps) QoS Realtime Average Data Rate Downstream : (kbps) QoS Burst Data Rate Downstream : (kbps) QoS Realtime Burst Data Rate Downstream : (kbps) [...]

```
Encryption Cipher : CCMP (AES)
Authentication Key Management : SAE
AAA override passphrase : No
SAE PWE Method : Hash to Element(H2E)
[...]
Protected Management Frame - 802.11w : Yes
[...]
Session Manager:
Point of Attachment : capwap_90000025
IIF ID : 0x90000025
Authorized : TRUE
Session timeout : 86400
Common Session ID: 0000000000171CC520478F
Acct Session ID : 0x0000000
Auth Method Status List
Method : SAE
Local Policies:
Service Template : wlan_svc_Policy4TiagoHome (priority 254)
VLAN : default
Absolute-Timer : 86400
Server Policies:
Resultant Policies:
VLAN Name : default
VLAN : 1
Absolute-Timer : 86400
[...]
FlexConnect Data Switching : Local
FlexConnect Dhcp Status : Local
FlexConnect Authentication : Local
Client Statistics:
Number of Bytes Received from Client : 335019921
Number of Bytes Sent to Client : 3315418
Number of Packets Received from Client : 250583
Number of Packets Sent to Client : 38960
Number of Policy Errors : 0
Radio Signal Strength Indicator : -54 dBm
Signal to Noise Ratio : 39 dB
[...]
Device Classification Information:
Device Type : LENOVO 21CCS43W0T
```

Policy Type : WPA3

Protocol Map : 0x000429 (OUI, DOT11, DHCP, HTTP) Device OS : Windows 10

#### 以下可查看每個用戶端提供的網路詳細資訊:



## 疑難排解

本文的疑難排解章節目的在於提供 WLAN 廣播問題疑難排解的一般指引,而非針對採用本文所述頻 帶作業時可能發生的用戶端問題。

使用者端的疑難排解取決於使用者端作業系統。Windows允許掃描網路,並確定筆記型電腦是否聽 到6GHz BSSID。有關共置AP的部分向您顯示了透過RNR報告從相同AP中獲知的其他BSSID。

C:\Windows\System32>netsh wlan show networks mode=Bssid

```
Interface name : A8000_NETGEAR
There are 4 networks currently visible.
(...)
```

SSID 3 : Darchis6	
Network type	: Infrastructure
Authentication	: WPA3-Personal
Encryption	: CCMP
BSSID 1	: 10:a8:29:30:0d:07
Signal	: 6%
Radio type	: 802.11ax
Band	: 6 GHz
Channel	: 69
Hash-to-Element:	: Supported
Bss Load:	

```
Connected Stations: 0
Channel Utilization: 2 (0 %)
         Medium Available Capacity: 23437 (749984 us/s)
     Colocated APs: : 3
        BSSID: 10:a8:29:30:0d:01, Band: 2.4 GHz, Channel: 1
        BSSID: 10:a8:29:30:0d:0f, Band: 5 GHz , Channel: 36
        BSSID: 10:a8:29:30:0d:0e, Band: 5 GHz , Channel: 36
     Basic rates (Mbps) : 6 12 24
     Other rates (Mbps) : 9 18 36 48 54
BSSID 2
                   : 10:a8:29:30:0d:0f
     Signal
                        : 57%
     Band
Channel
                        : 5 GHz
                          : 36
     Hash-to-Element: : Supported
     Bss Load:
         Connected Stations: 0
Channel Utilization: 9 (3 %)
         Medium Available Capacity: 23437 (749984 us/s)
     Colocated APs: : 1
        BSSID: 10:a8:29:30:0d:07, Band: 6 GHz , Channel: 69
     Basic rates (Mbps) : 6 12 24
     Other rates (Mbps) : 9 18 36 48 54

      3
      : 18:f9:35:4d:9d:67

      Signal
      : 79%

      Radio type
      : 802.11ax

      Band
      : 60%

BSSID 3
     Band
Channel
                         : 6 GHz
                          : 37
     Hash-to-Element: : Supported
     Bss Load:
         Connected Stations: 0
Channel Utilization: 2 (0 %)
         Medium Available Capacity: 23437 (749984 us/s)
     Colocated APs: : 3
        BSSID: 18:f9:35:4d:9d:6f, Band: 5 GHz , Channel: 52
        BSSID: 18:f9:35:4d:9d:6e, Band: 5 GHz , Channel: 52
BSSID: 18:f9:35:4d:9d:61, Band: 2.4 GHz, Channel: 11
     Basic rates (Mbps) : 6 12 24
     Other rates (Mbps) : 9 18 36 48 54
```



注意:使用<u>命令</u>之前<u>,請先參閱</u>debug有關<u>Debug</u>命令的<u>重要資訊</u>。

若要疑難排解用戶端連線問題,建議參考以下文件:

Catalyst 9800 用戶端連線問題流程疑難排解。

瞭解 Catalyst 9800 無線 LAN 控制器的無線偵錯和記錄收集作業。

若要疑難排解 AP 問題,建議參考以下文件:

疑難排解 COS AP

如需瞭解輸送量計算和驗證方式,請參閱以下指南:

802.11ac 無線輸送量測試和驗證指南。

雖然此指南是在 11ac 推出時製作而成,但同樣的計算方式也適用於 11ax。

#### 相關資訊

<u>什麼是 Wi-Fi 6E?</u>

<u>什麼是 Wi-Fi 6 與 Wi-Fi 6E?</u>

<u>Wi-Fi 6E 概覽</u>

<u>Wi-Fi 6E: Wi-Fi 白皮書重要新篇章</u>

<u>Cisco Live - 使用 Catalyst Wi-Fi 6E 存取點架構新世代無線網路</u>

<u>啟用 Wi-Fi 6 GHz 頻帶 (Wi-Fi 6E) 的國家與地區</u>

Cisco Catalyst 9800 系列無線控制器軟體設定指南 17.9.x

WPA3 部署指南

### 關於此翻譯

思科已使用電腦和人工技術翻譯本文件,讓全世界的使用者能夠以自己的語言理解支援內容。請注 意,即使是最佳機器翻譯,也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準 確度概不負責,並建議一律查看原始英文文件(提供連結)。