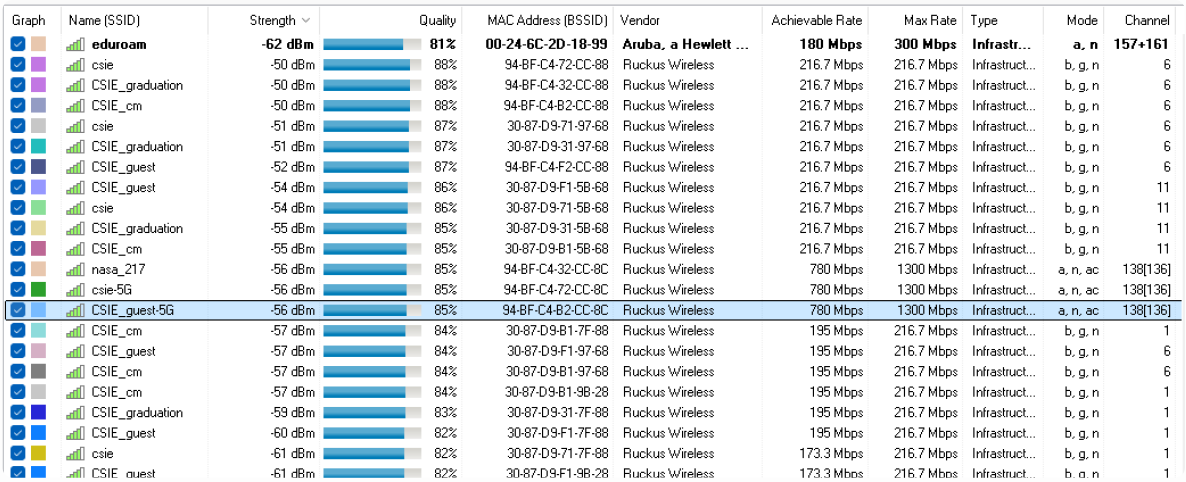
# NASA Lab11

B11901164 陳秉緯

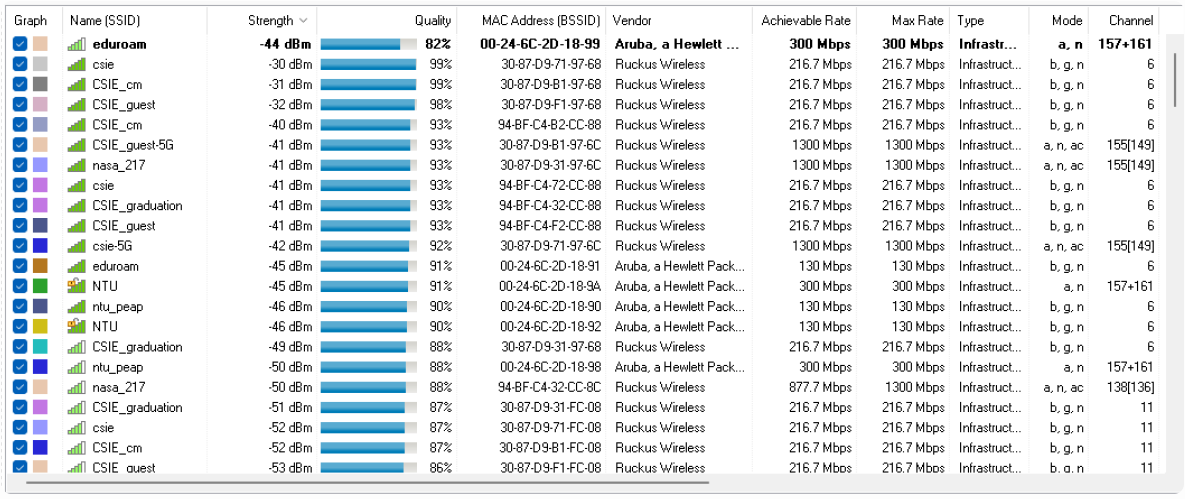
## 1. 測量數據

- 離 AP 最遠(未隔牆)點



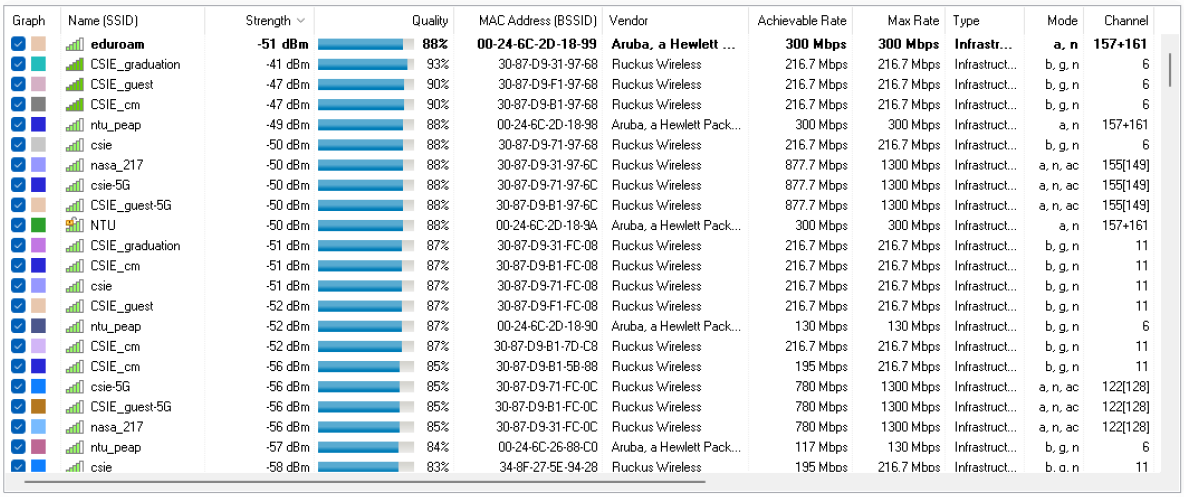
| Graph | Name (SSID) | Strength | Quality | MAC Address (BSSID) | Vendor | Achievable Rate | Max Rate | Type | Mode | Channel |
|---|---|---|---|---|---|---|---|---|---|---|
| | **eduroam** | **-62 dBm** | **81%** | **00-24-6C-2D-18-99** | **Aruba, a Hewlett ...** | **180 Mbps** | **300 Mbps** | **Infrastr...** | **a, n** | **157+161** |
| | csie | -50 dBm | 88% | 94-BF-C4-72-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_graduation | -50 dBm | 88% | 94-BF-C4-32-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_cm | -50 dBm | 88% | 94-BF-C4-B2-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | csie | -51 dBm | 87% | 30-87-D9-71-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_graduation | -51 dBm | 87% | 30-87-D9-31-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_guest | -52 dBm | 87% | 94-BF-C4-F2-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_guest | -54 dBm | 86% | 30-87-D9-F1-5B-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | csie | -54 dBm | 86% | 30-87-D9-71-5B-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | CSIE_graduation | -55 dBm | 85% | 30-87-D9-31-5B-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | CSIE_cm | -55 dBm | 85% | 30-87-D9-B1-5B-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | nasa_217 | -56 dBm | 85% | 94-BF-C4-32-CC-8C | Ruckus Wireless | 780 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 138[136] |
| | csie-5G | -56 dBm | 85% | 94-BF-C4-72-CC-8C | Ruckus Wireless | 780 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 138[136] |
| | CSIE_guest-5G | -56 dBm | 85% | 94-BF-C4-B2-CC-8C | Ruckus Wireless | 780 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 138[136] |
| | CSIE_cm | -57 dBm | 84% | 30-87-D9-B1-7F-88 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 1 |
| | CSIE_guest | -57 dBm | 84% | 30-87-D9-F1-97-68 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_cm | -57 dBm | 84% | 30-87-D9-B1-97-68 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_cm | -57 dBm | 84% | 30-87-D9-B1-9B-28 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 1 |
| | CSIE_graduation | -59 dBm | 83% | 30-87-D9-31-7F-88 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 1 |
| | CSIE_guest | -60 dBm | 82% | 30-87-D9-F1-7F-88 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 1 |
| | csie | -61 dBm | 82% | 30-87-D9-71-7F-88 | Ruckus Wireless | 173.3 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 1 |
| | CSIE_guest | -61 dBm | 82% | 30-87-D9-F1-9B-28 | Ruckus Wireless | 173.3 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 1 |

- 離 AP 最近點



| Graph | Name (SSID) | Strength | Quality | MAC Address (BSSID) | Vendor | Achievable Rate | Max Rate | Type | Mode | Channel |
|---|---|---|---|---|---|---|---|---|---|---|
| | **eduroam** | **-44 dBm** | **82%** | **00-24-6C-2D-18-99** | **Aruba, a Hewlett ...** | **300 Mbps** | **300 Mbps** | **Infrastr...** | **a, n** | **157+161** |
| | csie | -30 dBm | 99% | 30-87-D9-71-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_cm | -31 dBm | 99% | 30-87-D9-B1-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_guest | -32 dBm | 98% | 30-87-D9-F1-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_cm | -40 dBm | 93% | 94-BF-C4-B2-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_guest-5G | -41 dBm | 93% | 30-87-D9-B1-97-6C | Ruckus Wireless | 1300 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 155[149] |
| | nasa_217 | -41 dBm | 93% | 30-87-D9-31-97-6C | Ruckus Wireless | 1300 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 155[149] |
| | csie | -41 dBm | 93% | 94-BF-C4-72-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_graduation | -41 dBm | 93% | 94-BF-C4-32-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_guest | -41 dBm | 93% | 94-BF-C4-F2-CC-88 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | csie-5G | -42 dBm | 92% | 30-87-D9-71-97-6C | Ruckus Wireless | 1300 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 155[149] |
| | eduroam | -45 dBm | 91% | 00-24-6C-2D-18-91 | Aruba, a Hewlett Pack... | 130 Mbps | 130 Mbps | Infrastruct... | b, g, n | 6 |
| | NTU | -45 dBm | 91% | 00-24-6C-2D-18-9A | Aruba, a Hewlett Pack... | 300 Mbps | 300 Mbps | Infrastruct... | a, n | 157+161 |
| | ntu_peap | -46 dBm | 90% | 00-24-6C-2D-18-90 | Aruba, a Hewlett Pack... | 130 Mbps | 130 Mbps | Infrastruct... | b, g, n | 6 |
| | NTU | -46 dBm | 90% | 00-24-6C-2D-18-92 | Aruba, a Hewlett Pack... | 130 Mbps | 130 Mbps | Infrastruct... | b, g, n | 6 |
| | CSIE_graduation | -49 dBm | 88% | 30-87-D9-31-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| | ntu_peap | -50 dBm | 88% | 00-24-6C-2D-18-98 | Aruba, a Hewlett Pack... | 300 Mbps | 300 Mbps | Infrastruct... | a, n | 157+161 |
| | nasa_217 | -50 dBm | 88% | 94-BF-C4-32-CC-8C | Ruckus Wireless | 877.7 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 138[136] |
| | CSIE_graduation | -51 dBm | 87% | 30-87-D9-31-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | csie | -52 dBm | 87% | 30-87-D9-71-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | CSIE_cm | -52 dBm | 87% | 30-87-D9-B1-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| | CSIE_guest | -53 dBm | 86% | 30-87-D9-F1-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |

- 和 AP 隔著牆壁



| Graph | Name (SSID) | Strength | Quality | MAC Address (BSSID) | Vendor | Achievable Rate | Max Rate | Type | Mode | Channel |
|---|---|---|---|---|---|---|---|---|---|---|
| ☑ | **eduroam** | **-51 dBm** | **88%** | **00-24-6C-2D-18-99** | **Aruba, a Hewlett ...** | **300 Mbps** | **300 Mbps** | **Infrastr...** | **a, n** | **157+161** |
| ☑ | CSIE_graduation | -41 dBm | 93% | 30-87-D9-31-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| ☑ | CSIE_guest | -47 dBm | 90% | 30-87-D9-F1-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| ☑ | CSIE_cm | -47 dBm | 90% | 30-87-D9-B1-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| ☑ | ntu_peap | -49 dBm | 88% | 00-24-6C-2D-18-98 | Aruba, a Hewlett Pack... | 300 Mbps | 300 Mbps | Infrastruct... | a, n | 157+161 |
| ☑ | csie | -50 dBm | 88% | 30-87-D9-71-97-68 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 6 |
| ☑ | nasa_217 | -50 dBm | 88% | 30-87-D9-31-97-6C | Ruckus Wireless | 877.7 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 155[149] |
| ☑ | csie-5G | -50 dBm | 88% | 30-87-D9-71-97-6C | Ruckus Wireless | 877.7 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 155[149] |
| ☑ | CSIE_guest-5G | -50 dBm | 88% | 30-87-D9-B1-97-6C | Ruckus Wireless | 877.7 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 155[149] |
| ☑ | NTU | -50 dBm | 88% | 00-24-6C-2D-18-9A | Aruba, a Hewlett Pack... | 300 Mbps | 300 Mbps | Infrastruct... | a, n | 157+161 |
| ☑ | CSIE_graduation | -51 dBm | 87% | 30-87-D9-31-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| ☑ | CSIE_cm | -51 dBm | 87% | 30-87-D9-B1-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| ☑ | csie | -51 dBm | 87% | 30-87-D9-71-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| ☑ | CSIE_guest | -52 dBm | 87% | 30-87-D9-F1-FC-08 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| ☑ | ntu_peap | -52 dBm | 87% | 00-24-6C-2D-18-90 | Aruba, a Hewlett Pack... | 130 Mbps | 130 Mbps | Infrastruct... | b, g, n | 6 |
| ☑ | CSIE_cm | -52 dBm | 87% | 30-87-D9-B1-7D-C8 | Ruckus Wireless | 216.7 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| ☑ | CSIE_cm | -56 dBm | 85% | 30-87-D9-B1-5B-88 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |
| ☑ | csie-5G | -56 dBm | 85% | 30-87-D9-71-FC-0C | Ruckus Wireless | 780 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 122[128] |
| ☑ | CSIE_guest-5G | -56 dBm | 85% | 30-87-D9-B1-FC-0C | Ruckus Wireless | 780 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 122[128] |
| ☑ | nasa_217 | -56 dBm | 85% | 30-87-D9-31-FC-0C | Ruckus Wireless | 780 Mbps | 1300 Mbps | Infrastruct... | a, n, ac | 122[128] |
| ☑ | ntu_peap | -57 dBm | 84% | 00-24-6C-26-88-C0 | Aruba, a Hewlett Pack... | 117 Mbps | 130 Mbps | Infrastruct... | b, g, n | 6 |
| ☑ | csie | -58 dBm | 83% | 34-8F-27-5E-94-28 | Ruckus Wireless | 195 Mbps | 216.7 Mbps | Infrastruct... | b, g, n | 11 |

SSID: CSIE_guest (2.4G and 5G)
表格：

| 地點 | 頻段 | Signal Strength (dBm) | Quality (%) | Transmission rate (Mb/s) |
|---|---|---|---|---|
| 離 AP 最遠(未隔牆)點 | 2.4G | -52 | 87 | 216.7 |
| 離 AP 最遠(未隔牆)點 | 5G | -56 | 85 | 780 |
| 離 AP 最近點 | 2.4G | -32 | 98 | 216.7 |
| 離 AP 最近點 | 5G | -41 | 93 | 1300 |
| 和 AP 隔著牆壁 | 2.4G | -47 | 90 | 216.7 |
| 和 AP 隔著牆壁 | 5G | -50 | 88 | 877.7 |

- Signal Strength: 訊號強度，以 dBm（負數）表示，數值越接近 0，表示訊號越強。
- SNR / Quality: 訊號與雜訊的比值，SNR 通常用 dB 表示，但 Windows 上用 Quality，表示百分比品質。
- Transmission Rate: 傳輸速率，表示目前與基地台之間的資料傳送速度，單位是 Mbps。

## 2. 分析數據

1. 距離對訊號與速率的影響：
    - 兩個頻段的訊號強度都隨距離增加而明顯衰減，例如 2.4G: -32 → -52 dBm。
    - 5G 雖訊號較弱，但速率仍明顯高於 2.4G，因為 5G 支援更高的 modulation（如 256-QAM）與頻寬（80MHz、160MHz）。

- 傳輸速率：距離越遠，5G 的速率下降幅度比 2.4G 顯著，但在最近距離時速度壓倒性優勢（1300 Mbps）。

2. 隔牆的影響與頻段比較：
   - 2.4G（低頻）穿透力較強，牆壁對訊號衰減影響小（從 -32 → -47 dBm）。
   - 5G 穿透力差，但數據中只衰減約 9 dB（-41 → -50 dBm），可能是牆體材質不太厚。
   - 儘管隔牆，5G 的速率依然維持高水準（877.7 Mbps），遠高於 2.4G 的 216.7 Mbps，這顯示信號強度並非唯一決定速率的因素，可能還包括 modulation scheme、channel bonding 等。

測量結果是否符合預期？
部分符合預期。整體趨勢符合無線電物理特性：

- 2.4GHz 穿牆能力好、覆蓋範圍大、速率較低。
- 5GHz 傳輸速率高但長距離表現不如 2.4G。
  但就以上數據而言，5G 隔著牆卻只衰減一點，就沒有符合預期的穿透力較弱。