



**Confidential**

**Document Type**

- Requirement (RQ)
- External Specification (ES)
- Internal Specification (IS)
- Design Specification (DS)
- Test Plan (TP)
- Release Note (RN)
- Bug Report (BR)
- Training Material (TM)
- Other Outdoor Test Report 3 Hops (OT)

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**Subject**

Outdoor Test Report  
of  
APM-10xR

**Revision History**

Rev.	Date	Author	Reason for Changes
1.0	Oct. 05, 2011	Jacky Cheng	• Initial draft(繁體中文版)
			•
			•



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## 1.0 Scope

### 1.1 Introduction

本文件主要說明 APM-10xR Outdoor Access Point 戶外測試報告。

### 1.2 Date/Time

- 測試日期：2011/10/05
- 測試時間：AM 11:00 ~ PM 16:00

### 1.3 Location

- 測試點 A：新竹高鐵站旁大樓
- 測試點 B：新竹高鐵站旁隘口一街
- 測試點 C：新竹高鐵頭前溪北岸堤防
- 測試點 D：頭前溪南岸

### 1.4 Equipment

- 無線設備：APM-103R x 4
- 天線設備：5GHz 2x2 MIMO 20dBi Panel Antenna x 6
- 電腦設備：ASUS A43F Series 筆電 x 2, Toshiba 小筆電 x 2
- 軟體設備：Windows XP SP3、IxChariot 5.40
- APM-103R Firmware Version：1.0(1110.0402)

### 1.5 Topology

- Multiple Hopping：3 Hops





## 2.0 Environment

本章節描述本次測試之環境條件因素。

### 2.1 GPS Location

圖一、“Google Earth Location 標示點”。

距離：

Point A to Point B : 320 公尺

Point B to Point C : 710 公尺

Point C to Point D : 930 公尺

Total Distances : 1,960m, 3 Hops





## 2.2 Fresnel Zone Graph

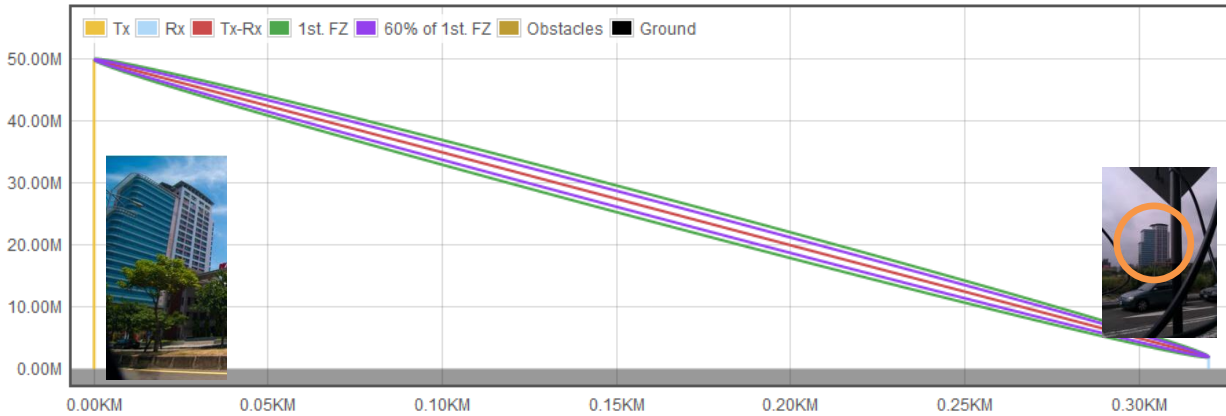
圖二、"Line of Sight 示意圖"。

Point A Antenna Height : 50 公尺(14 樓)

Point B Antenna Height : 2 公尺

### First Fresnel Zone Calculator

Tx Height  meter(s)   
 Tx-Rx Distance  KM   
 Frequency  MHz   
 Rx Height  meter(s)   
 Obstacles Height  meter(s)   
 Tx-Obstacles Distance  KM

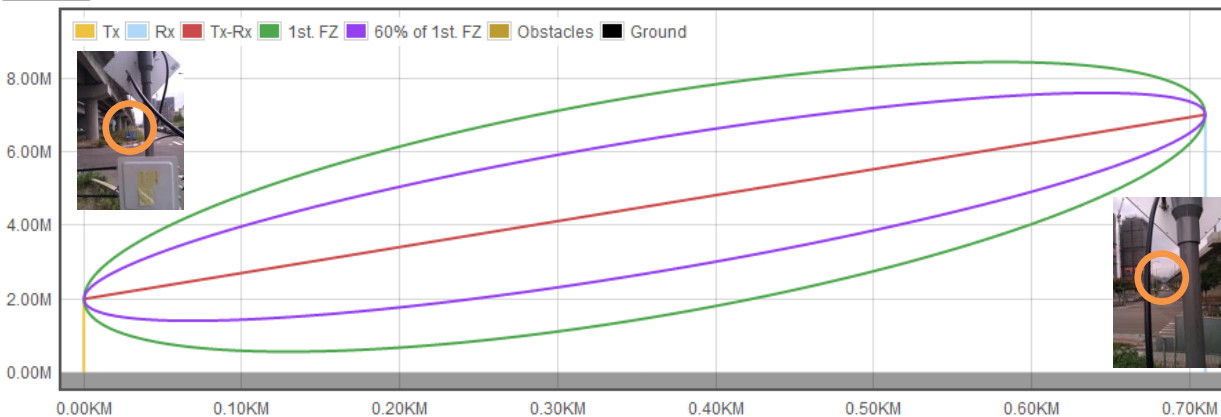


Point B Antenna Height : 2 公尺

Point C Antenna Height : 7 公尺(堤防上)

### First Fresnel Zone Calculator

Tx Height  meter(s)   
 Tx-Rx Distance  KM   
 Frequency  MHz   
 Rx Height  meter(s)   
 Obstacles Height  meter(s)   
 Tx-Obstacles Distance  KM



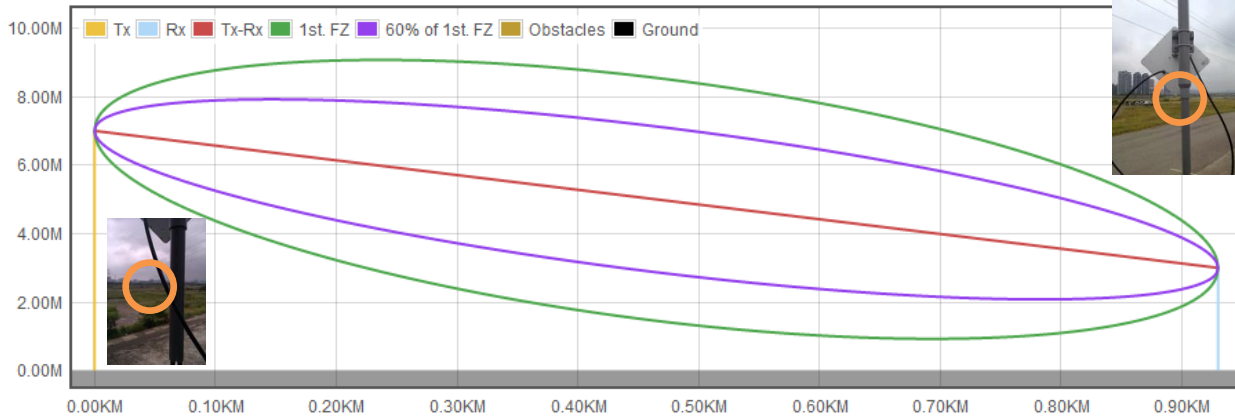


Point C Antenna Height : 7 公尺(堤防上)

Point D Antenna Height : 3 公尺

### First Fresnel Zone Calculator

Tx Height:  meter(s)    Tx-Rx Distance:  KM    Frequency:  MHz    Rx Height:  meter(s)    Obstacles Height:  meter(s)    Tx-Obstacles Distance:  KM





### 2.3 Spectrum

本次測試：

TX/RX Antenna Gain 為 20dBi

Cable Loss 約為 2dB

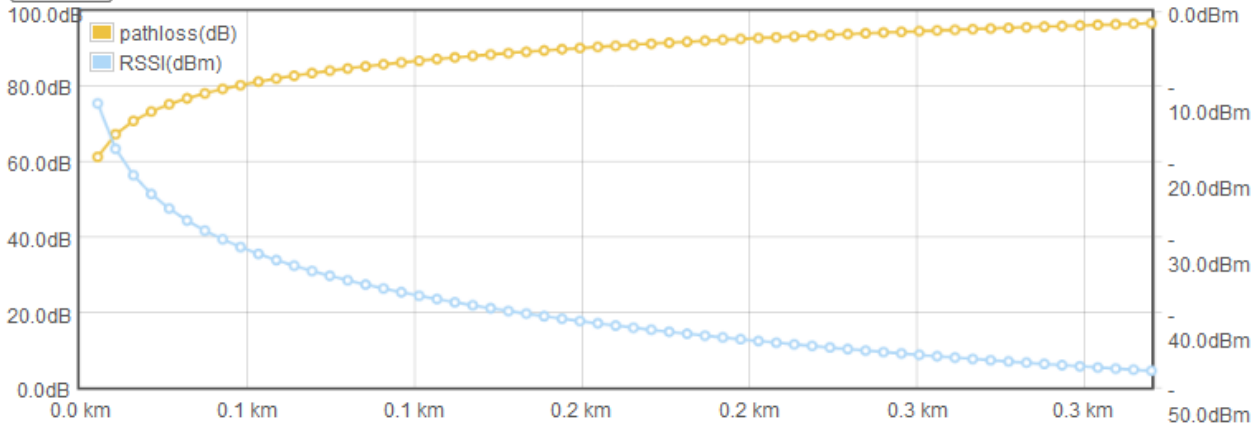
Link	Frequency	RF Tx power @HT40A/N MCS15	Noise Level	Pathloss 理論值	RSSI 理論值
A to B	5,180MHz	13dBm	-113dBm	96.8dB	-47.8dBm
B to C	5,785MHz	13dBm	-116dBm	104.7dB	-55.7dBm
C to D	5,540MHz	13dBm	-111dBm	106.7dB	-57.7dBm

Point A to Point B :

### Simple RSSI Calculator

<b>Transmitter</b>	<b>Free Space Path</b>	<b>Receiver</b>
Tx Power	Frequency	RSSI
<input type="text" value="13"/> dBm	<input type="text" value="5180"/> MHz	-47.83 dBm
Cable loss	Distance	Cable loss
<input type="text" value="2"/> dB	<input type="text" value="0.32"/> KM	<input type="text" value="2"/> dB
Antenna Gain	Path loss	Antenna Gain
<input type="text" value="20"/> dB	96.83 dB	<input type="text" value="20"/> dB
Received Sensitivity	Margin	
<input type="text" value="-75"/> dBm	<input type="text" value="10"/> dB	

Calculate





Point B to Point C :

### Simple RSSI Calculator

Transmitter

Tx Power  
 dBm

Cable loss  
 dB

Antenna Gain  
 dB

Received Sensitivity  
 dBm

Free Space Path

Frequency  
 MHz

Distance  
 KM

Path loss  
104.711 dB

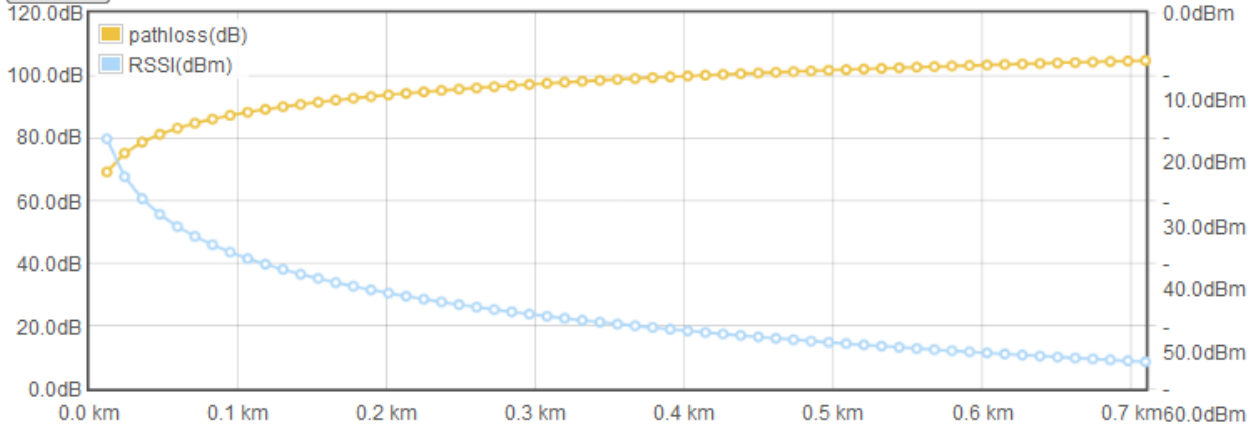
Receiver

RSSI  
-55.711 dBm

Cable loss  
 dB

Antenna Gain  
 dB

Margin  
 dB



Point C to Point D :

### Simple RSSI Calculator

Transmitter

Tx Power  
 dBm

Cable loss  
 dB

Antenna Gain  
 dB

Received Sensitivity  
 dBm

Free Space Path

Frequency  
 MHz

Distance  
 KM

Path loss  
106.68 dB

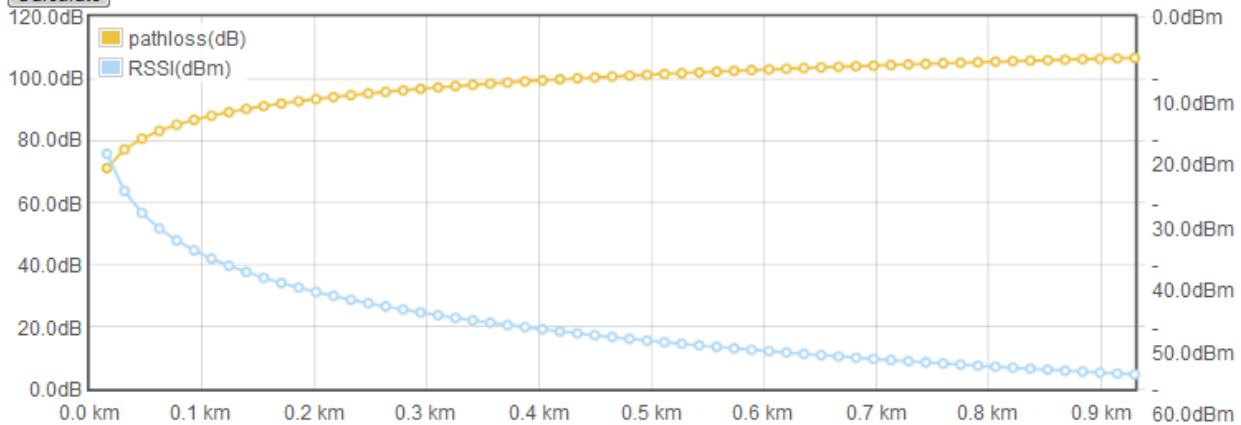
Receiver

RSSI  
-57.68 dBm

Cable loss  
 dB

Antenna Gain  
 dB

Margin  
 dB



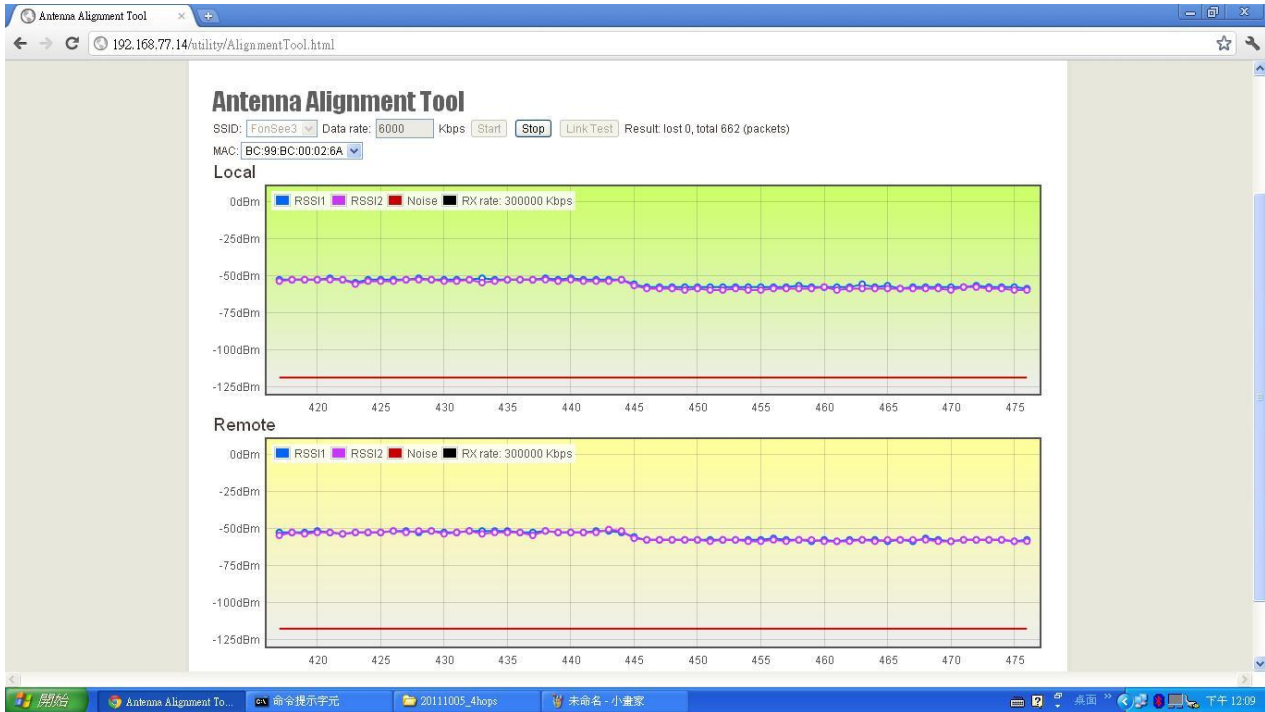




本次測試於各點實際所量得之數據分別為：

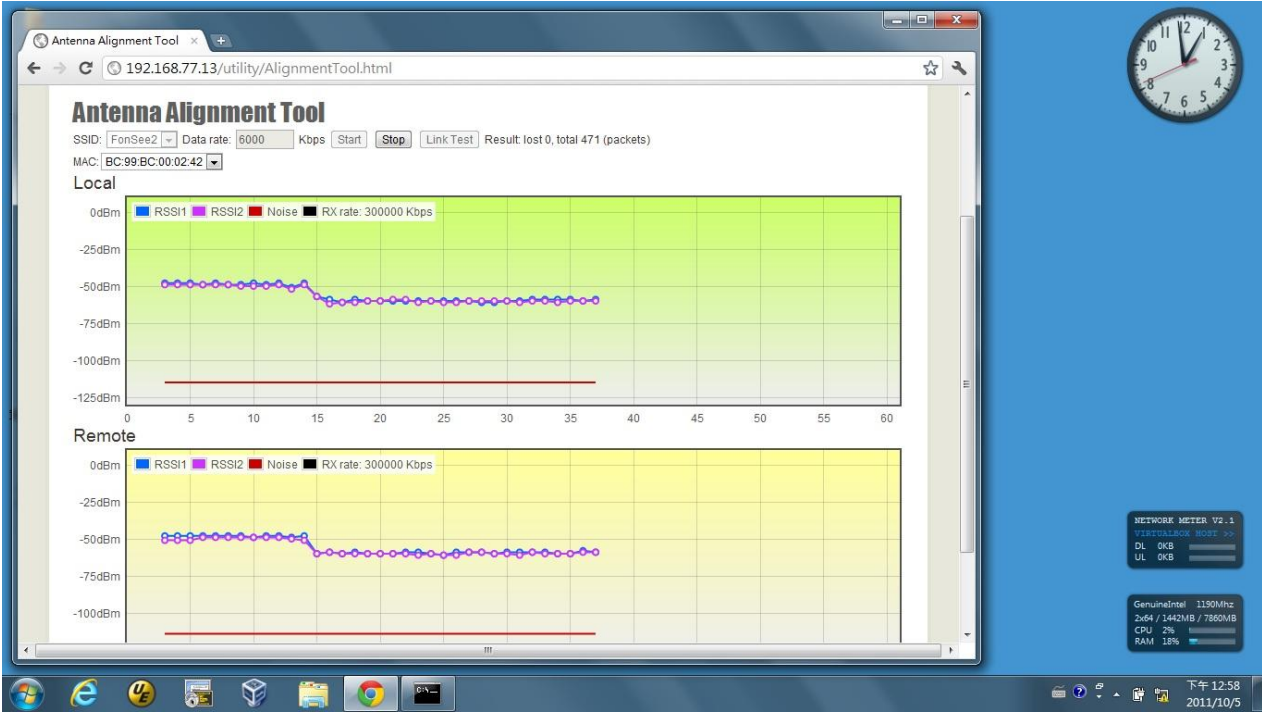
Link	RSSI 理論值	RSSI 量測值		Max. Link Rate
		A/B/C	B/C/D	
A to B	-47.8dBm	-53~-56dBm	-52~-54dBm	300Mbps
B to C	-55.7dBm	-58~-60dBm	-58~-60dBm	300Mbps
C to D	-57.7dBm	-61~-65dBm	--60~-62dBm	300Mbps

Point A(Local) to Point B(Remote) :

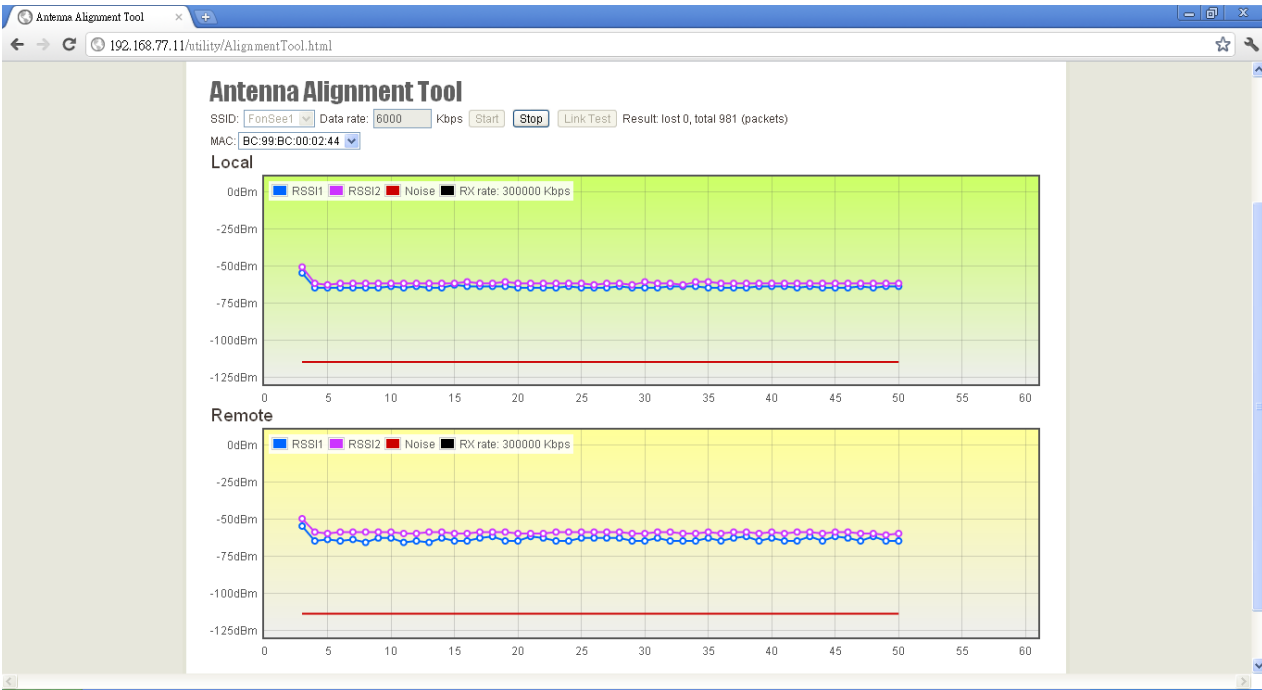




Point B(Local) to Point C(Remote) :



Point C(Remote) to Point D(Local) :





### 3.0 Test Results

測試部份以下列參數組合進行：

Distance 參數設定為 3Km

IxChariot test pair numbers

Frequency Channel Width

所有測試使用 IxChariot High Performance script。

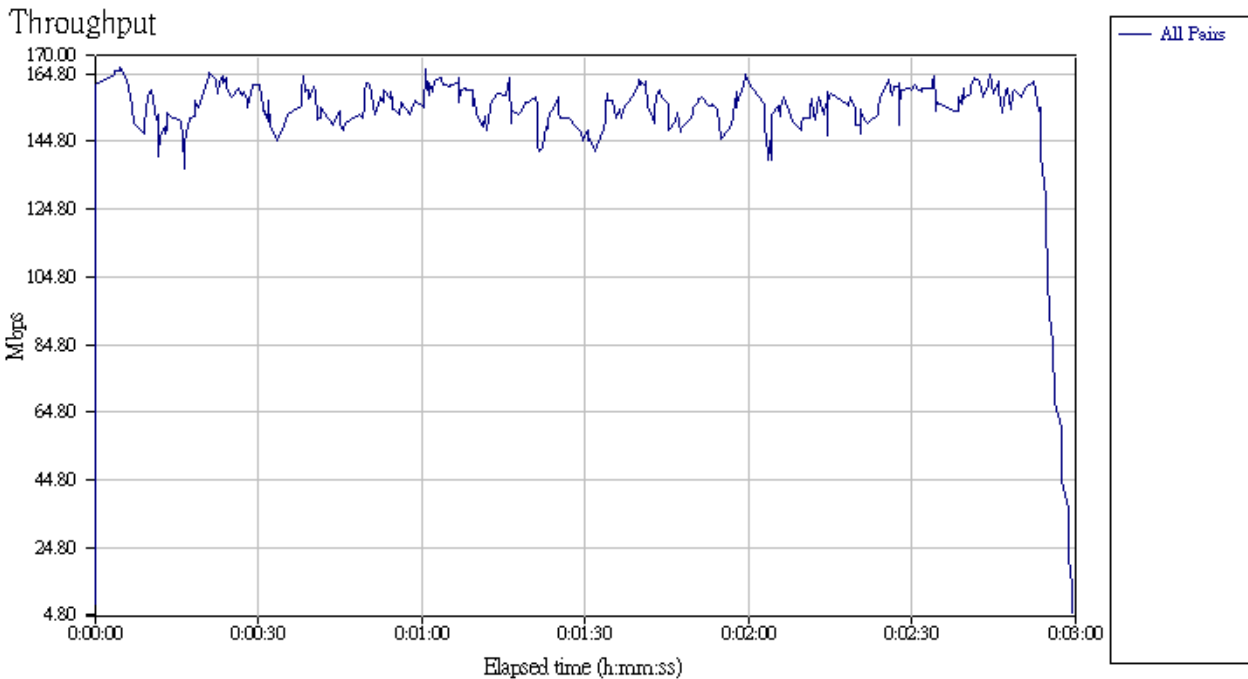
### 3.1 Test1

2 公里 / 中繼跳台 3 次 / 40MHz 擴頻 / 最末端頻寬 153Mbps (應用於道路監控與工地監控)

Channel Width	Tx/Rx Antenna Number	Short GI	IxChariot pairs	WMM Enable	WPA2 Security
40MHz	2T2R	On(400)	8T8R	Yes	No
Report	Total Throughput(Mbps)	Response Time		Transaction Rate	
	153.193	8.472		1.948	

### Throughput

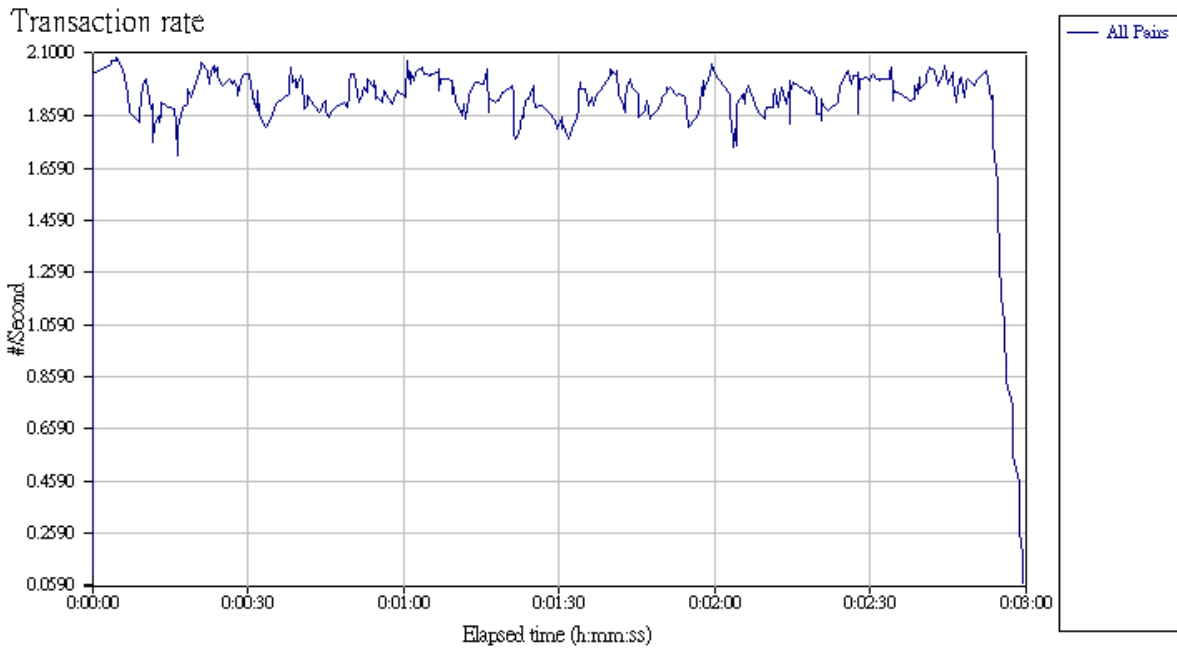
Pair 16	13.519	7.345	25.245
Totals:	153.193	3.596	25.245





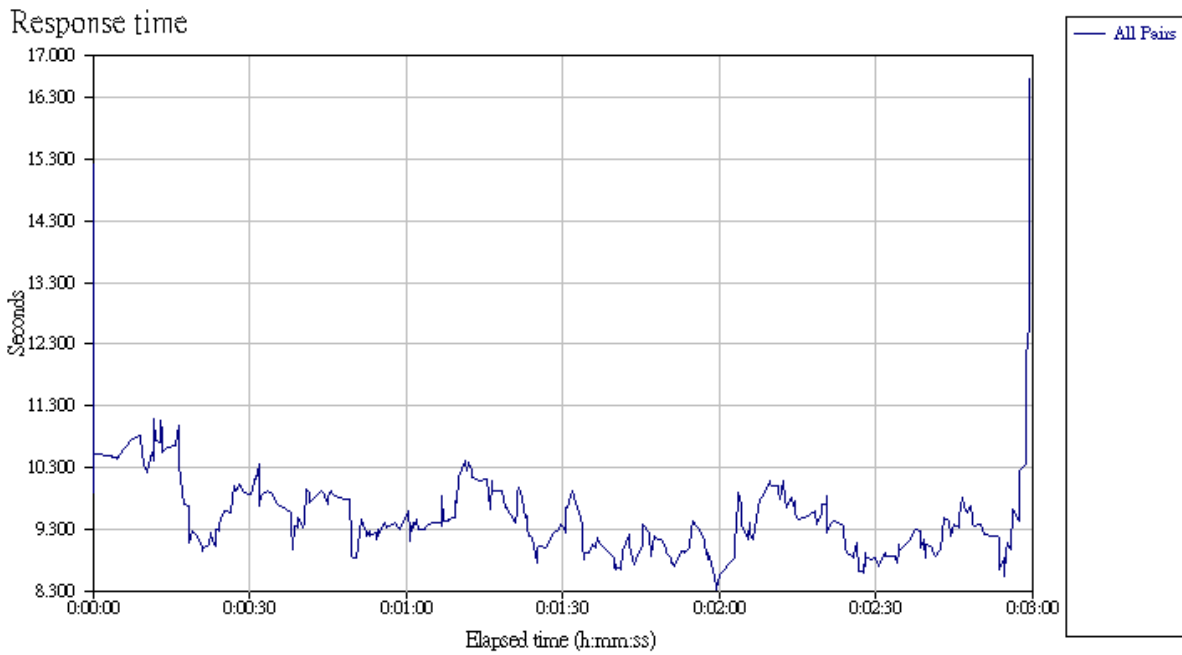
### Transaction Rate

Pair 16	0.169	0.092	0.316
Totals:	1.948	0.045	0.316



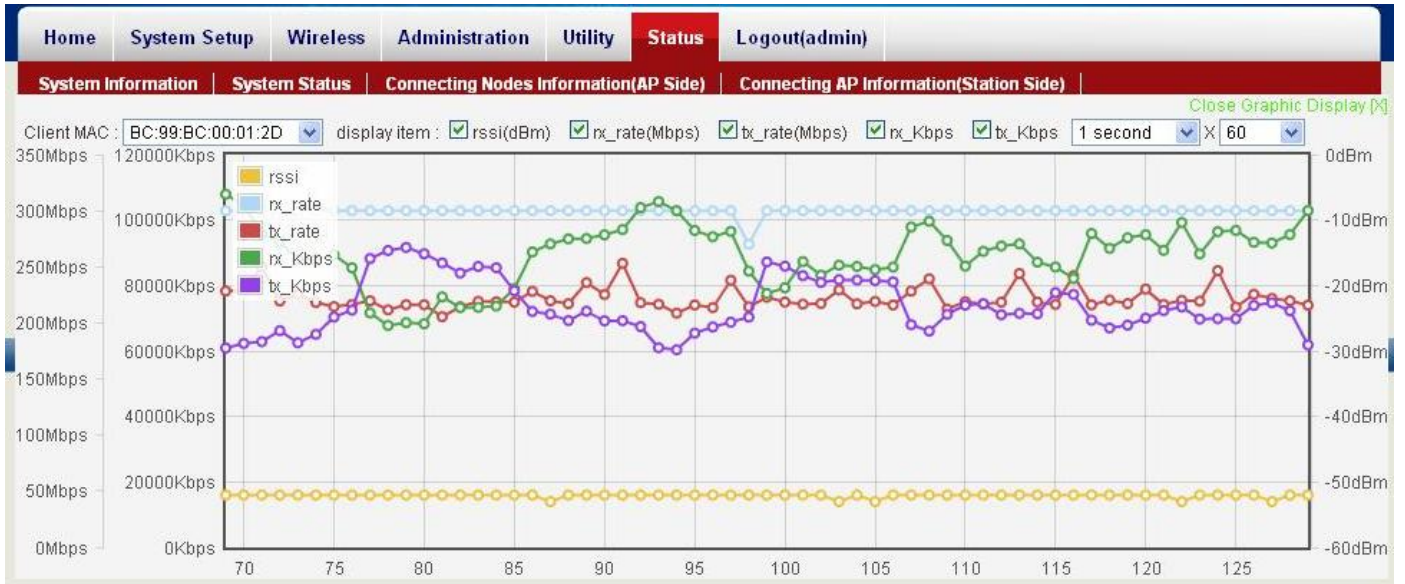
### Response Time

Pair 16	5.918	3.169	10.892
Totals:	8.472	3.169	22.244

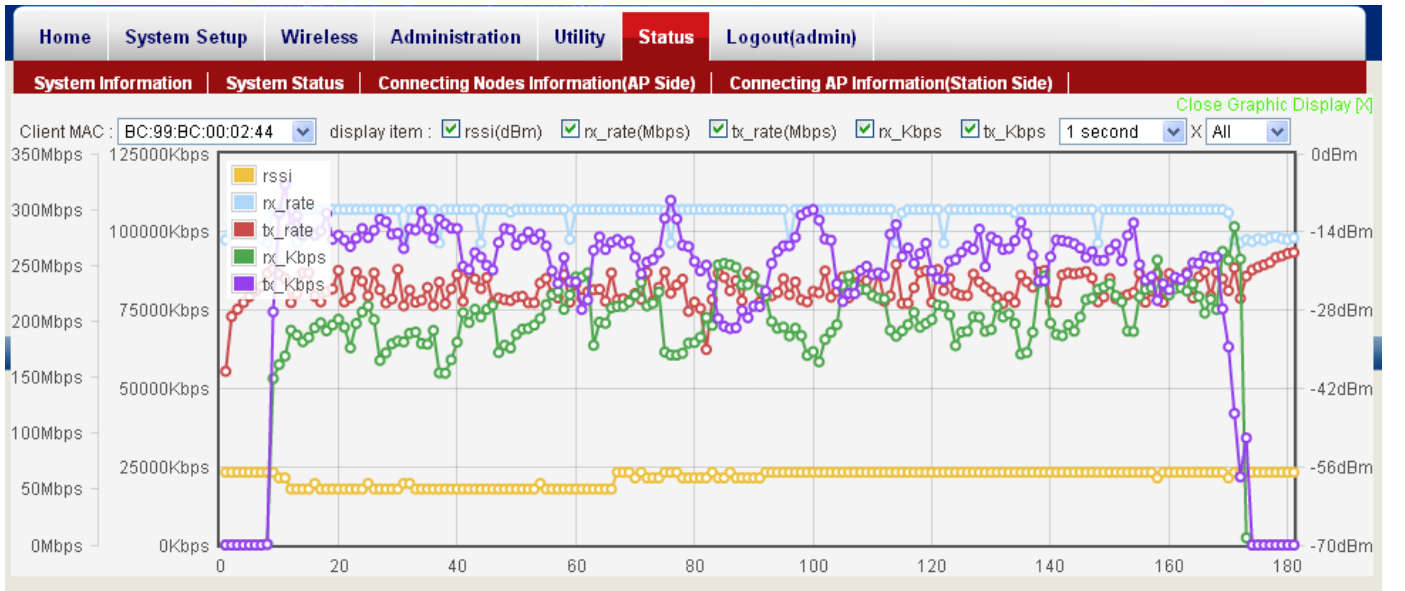




### Point A Screen



### Point D Screen





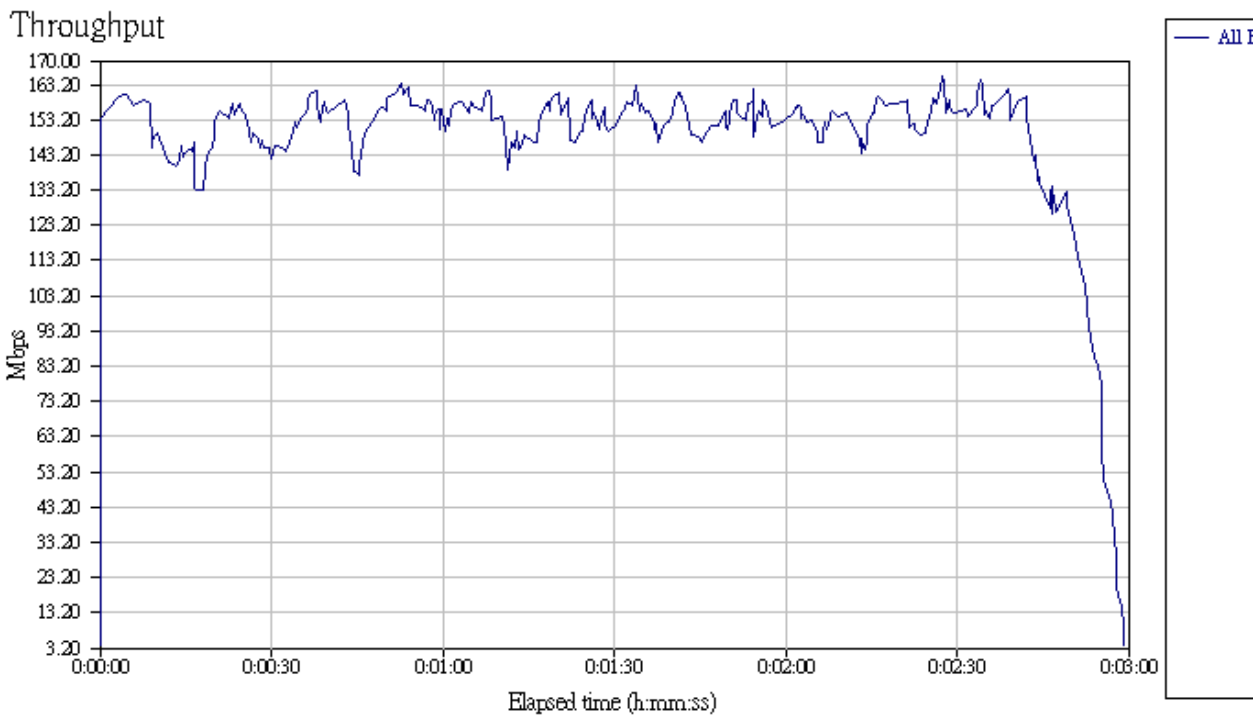
### 3.2 Test2

2 公里 / 中繼跳台 3 次 / 40MHz 擴頻 / 最末端頻寬 148Mbps (應用於道路監控與工地監控)

Channel Width	Tx/Rx Antenna Number	Short GI	IxChariot pairs	WMM Enable	WPA2 Security
40MHz	2T2R	On(400)	12T12R	No	No
Report	Total Throughput(Mbps)	Response Time		Transaction Rate	
	148.406	12.851		1.915	

### Throughput

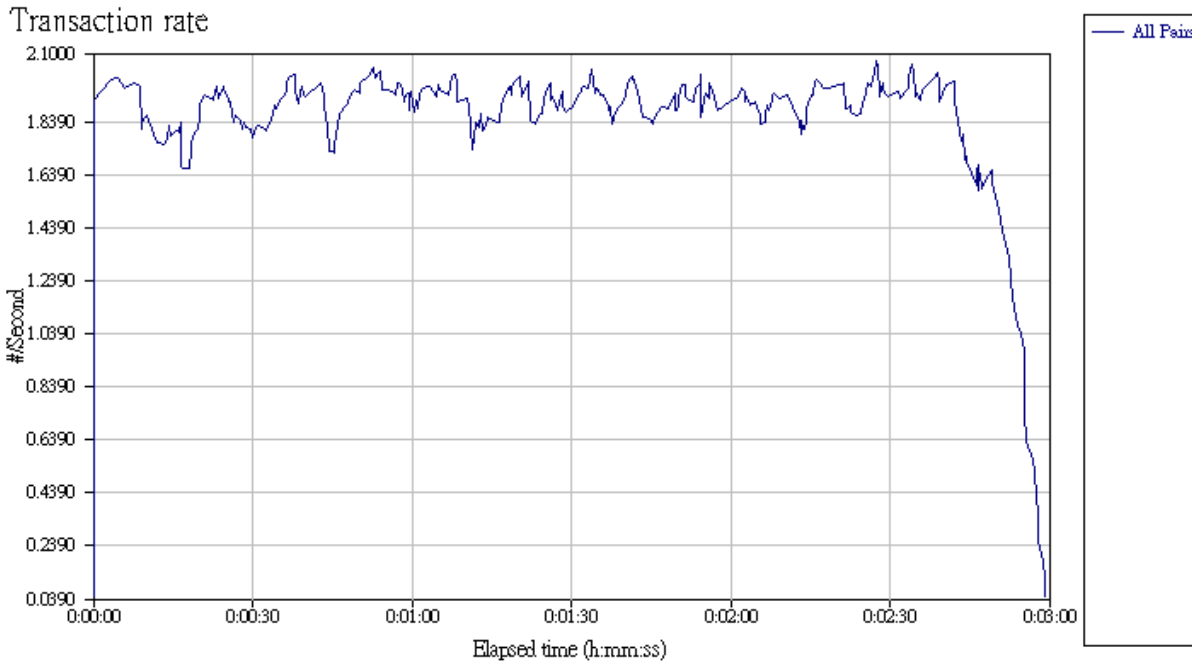
Pair 24	7.306	4.065	15.117
Totals:	148.406	2.837	30.407





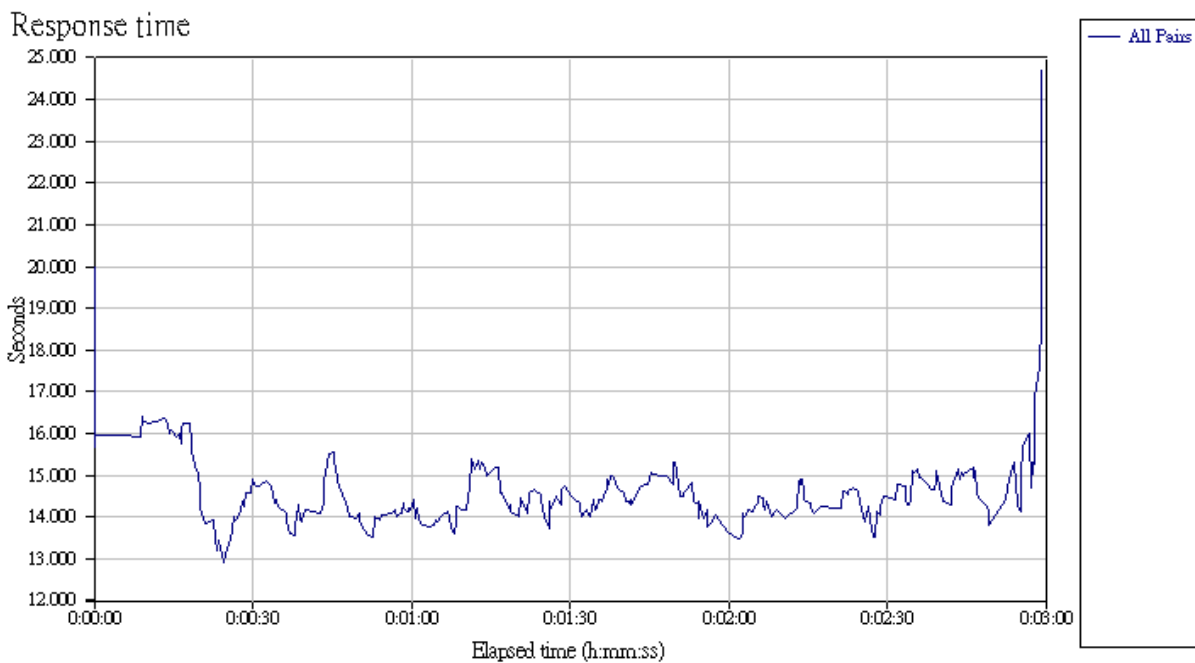
### Transaction Rate

Pair 24	0.091	0.051	0.189
Totals:	1.915	0.035	0.380



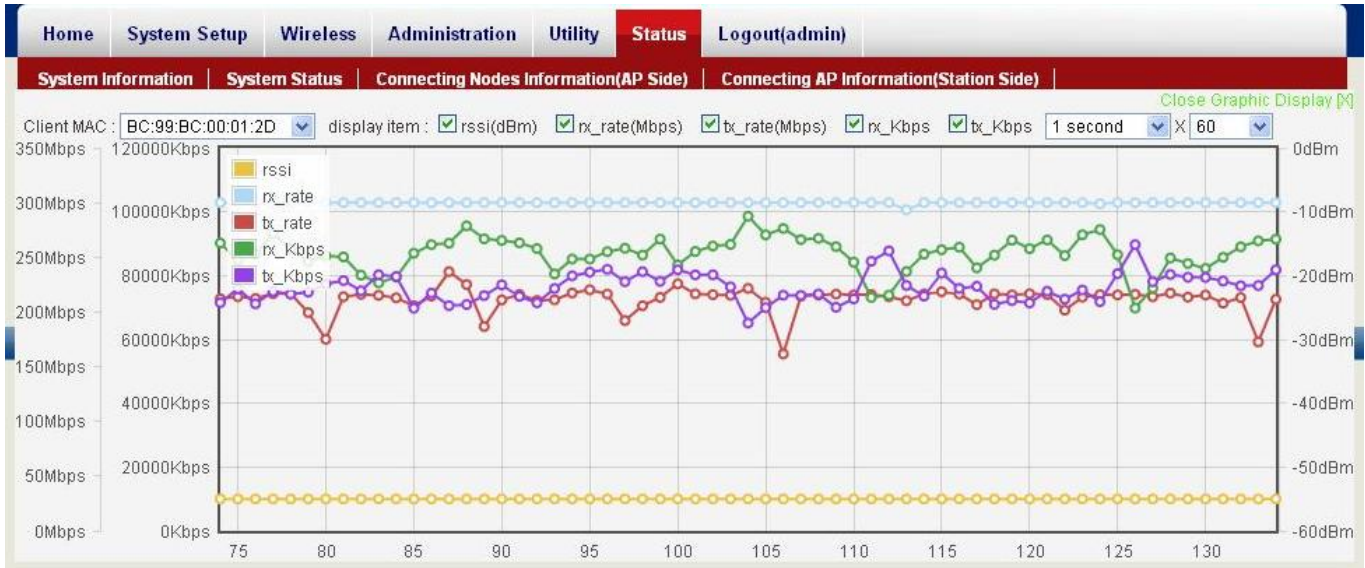
### Response Time

Pair 24	10.949	5.292	19.681
Totals:	12.851	2.631	28.197

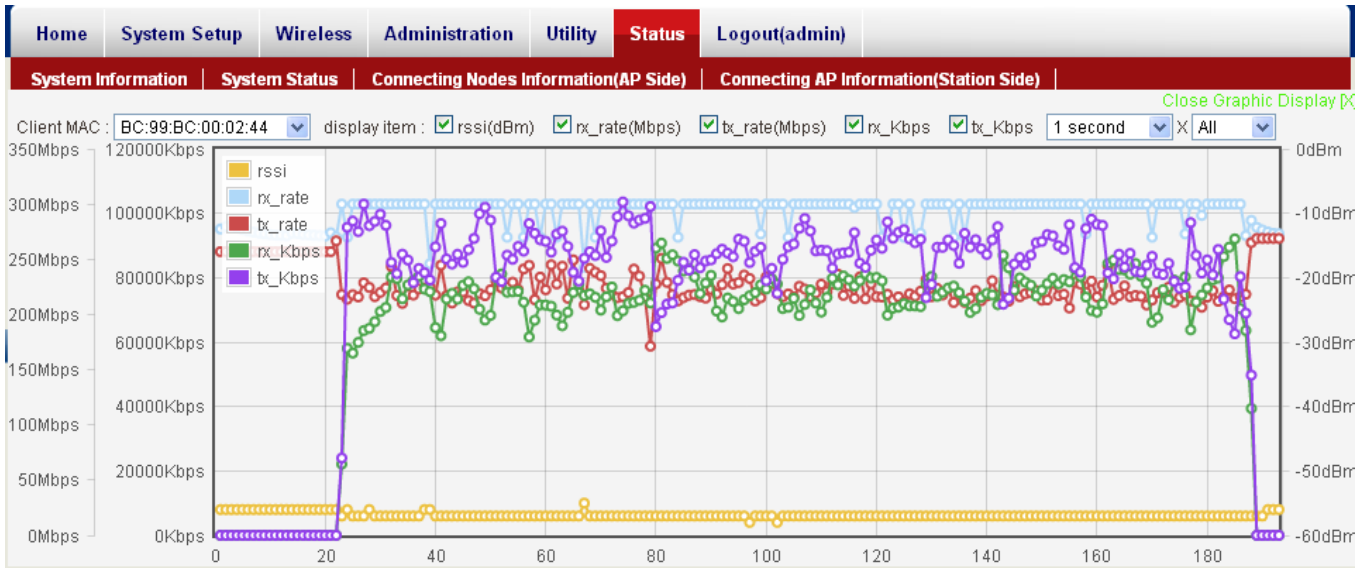




### Point A Screen



### Point D Screen







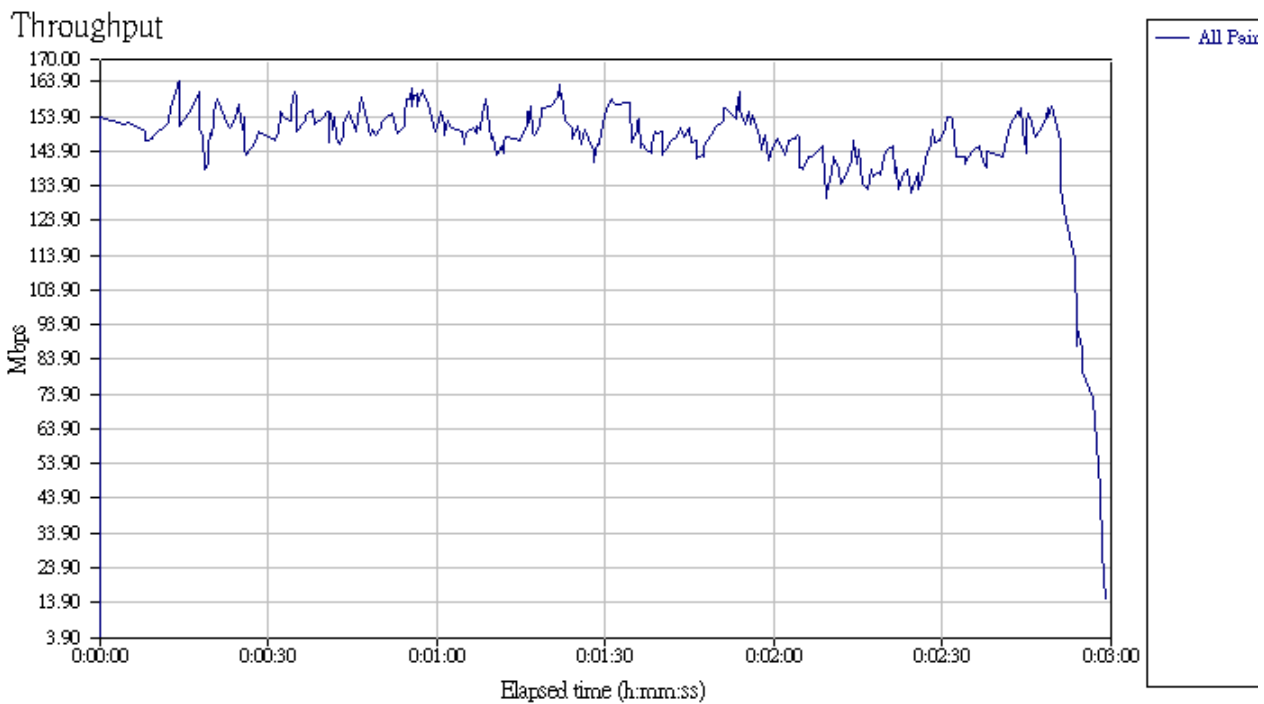
### 3.3 Test3

2 公里 / 中繼跳台 3 次 / 40MHz 擴頻 / 最末端頻寬 146Mbps (應用於道路監控與工地監控)

Channel Width	Tx/Rx Antenna Number	Short GI	IxChariot pairs	WMM Enable	WPA2 Security
40MHz	2T2R	On(400)	8T8R	No	Yes
Report	Total Throughput(Mbps)	Response Time		Transaction Rate	
	146.347	8.693		1.877	

### Throughput

Pair 16	11.219	6.727	20.434
Totals:	146.347	3.740	20.434

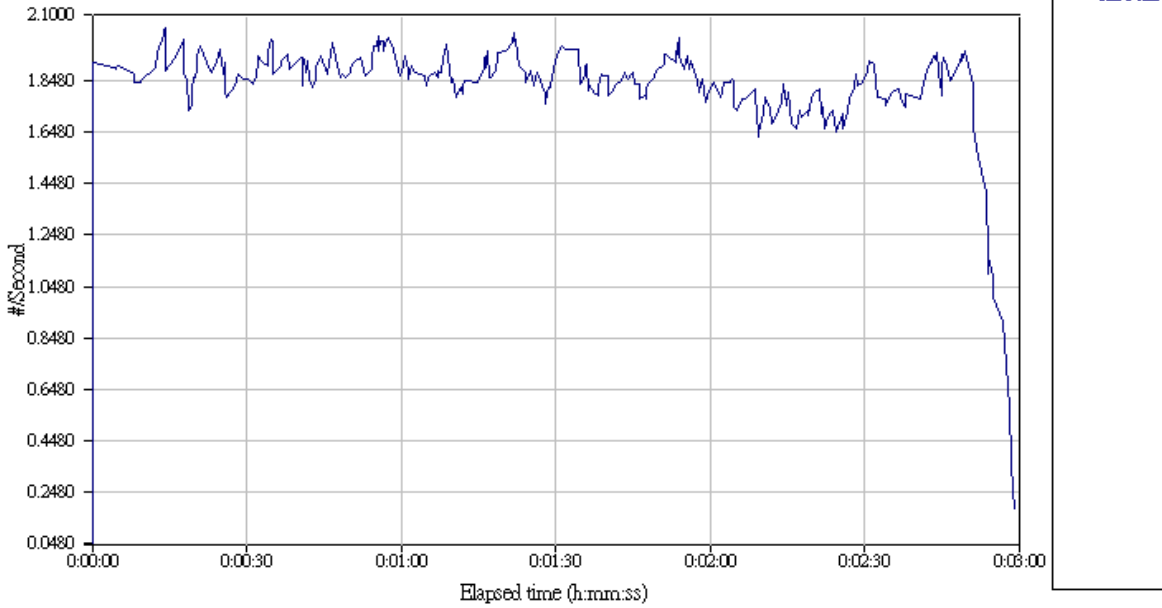




### Transaction Rate

Pair 16	0.140	0.084	0.255
Totals:	1.877	0.047	0.255

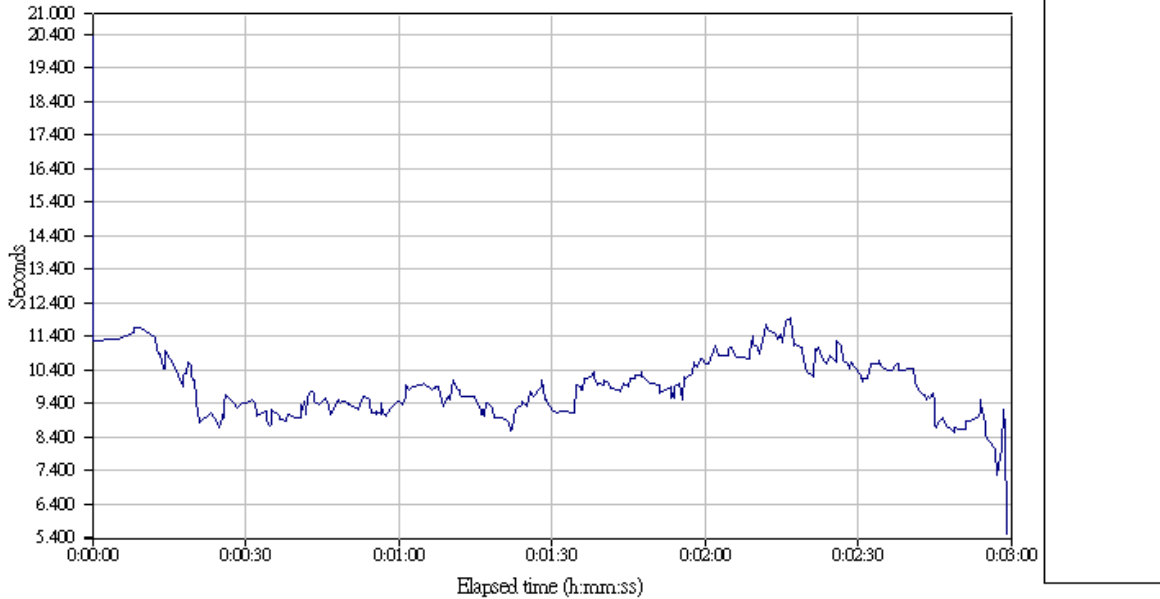
Transaction rate



### Response Time

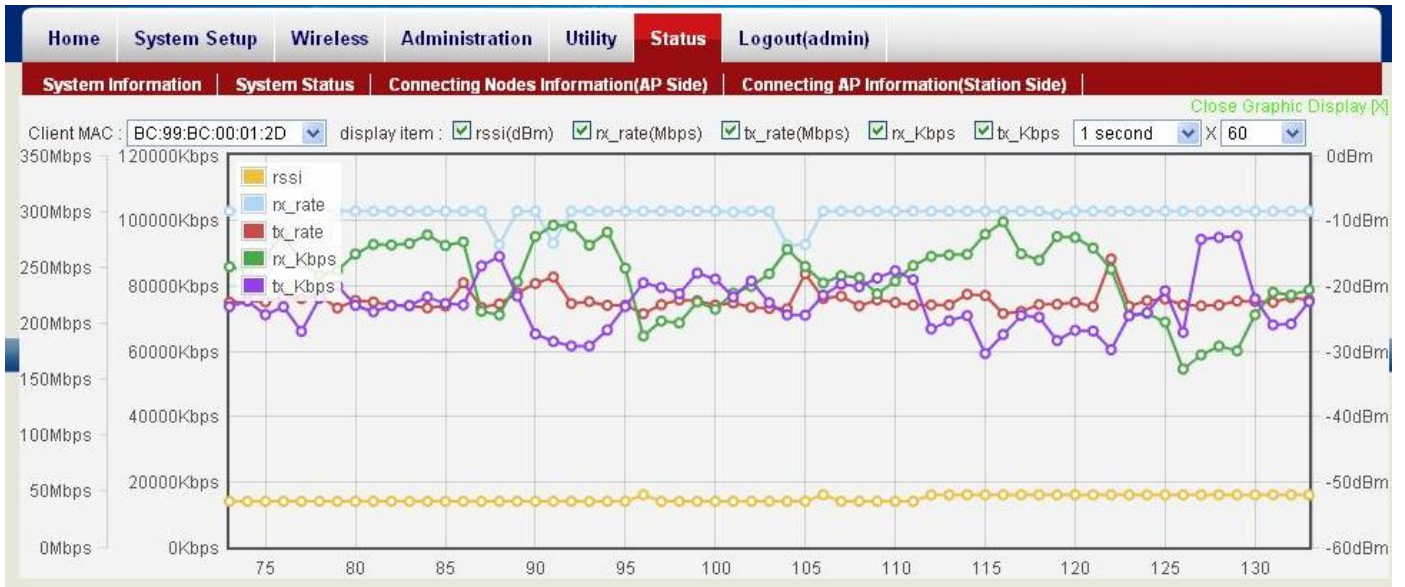
Pair 16	7.131	3.915	11.893
Totals:	8.693	3.915	21.389

Response time

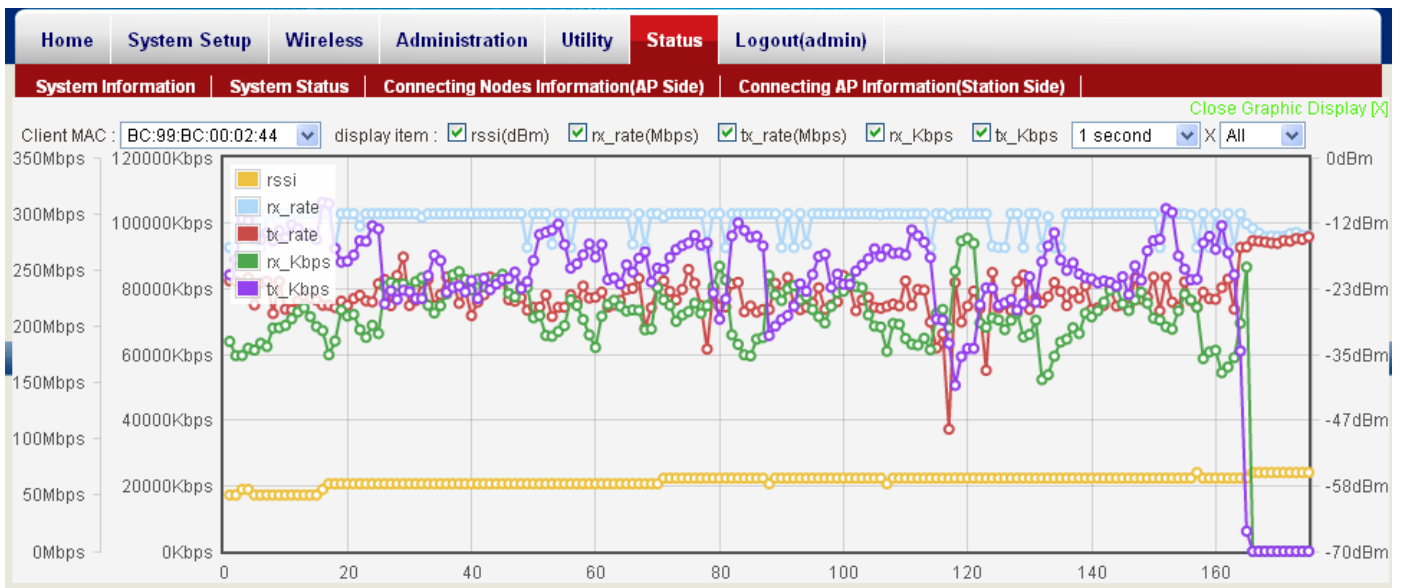




### Point A Screen



### Point D Screen





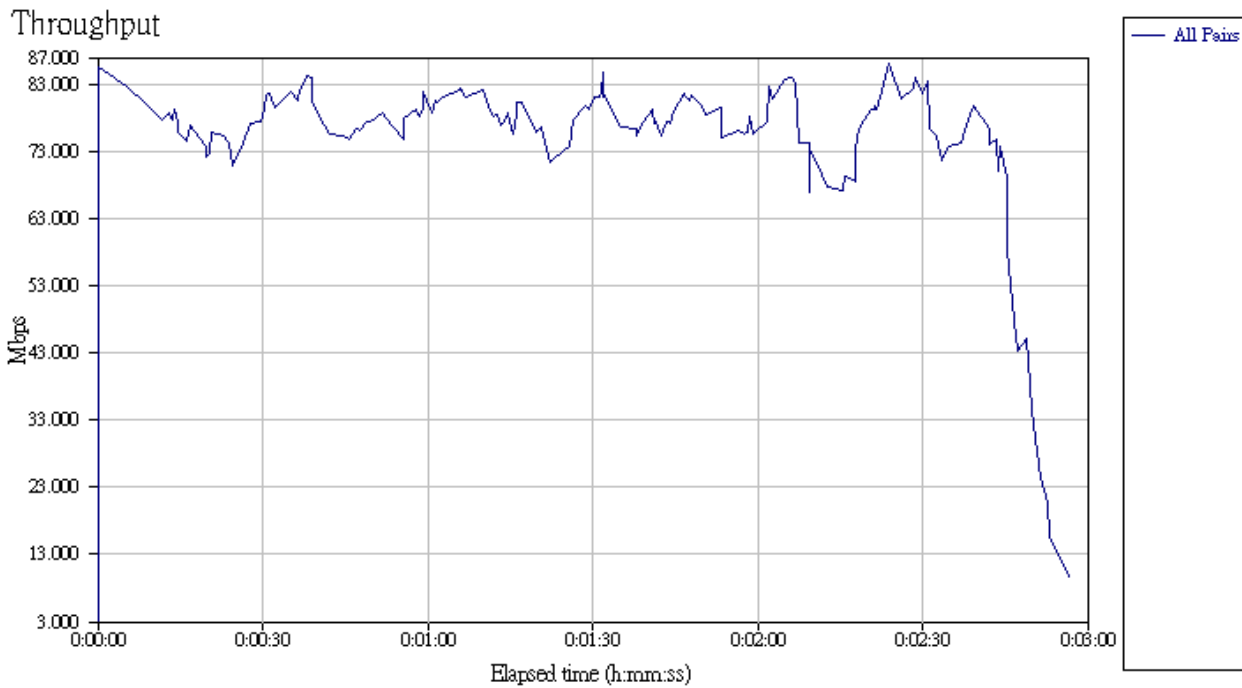
### 3.4 Test4

2 公里 / 中繼跳台 3 次 / 20MHz 單頻 / 最末端頻寬 74.5Mbps (應用於道路監控與工地監控)

Channel Width	Tx/Rx Antenna Number	Short GI	IxChariot pairs	WMM Enable	WPA2 Security
<b>20MHz</b>	2T2R	On(400)	8T8R	No	No
<b>Report</b>	<b>Total Throughput(Mbps)</b>	<b>Response Time</b>		<b>Transaction Rate</b>	
	<b>74.781</b>	<b>16.780</b>		<b>0.990</b>	

### Throughput

Pair 16	5.284	2.870	10.875
Totals:	74.781	2.191	15.226

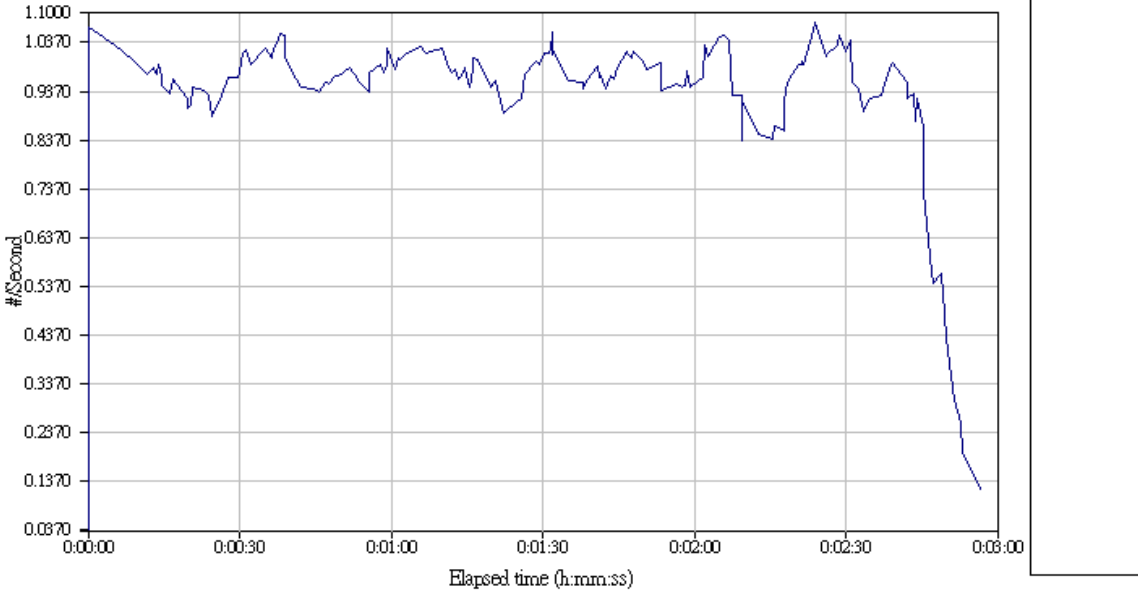




### Transaction Rate

Pair 16	0.066	0.036	0.136
Totals:	0.990	0.027	0.190

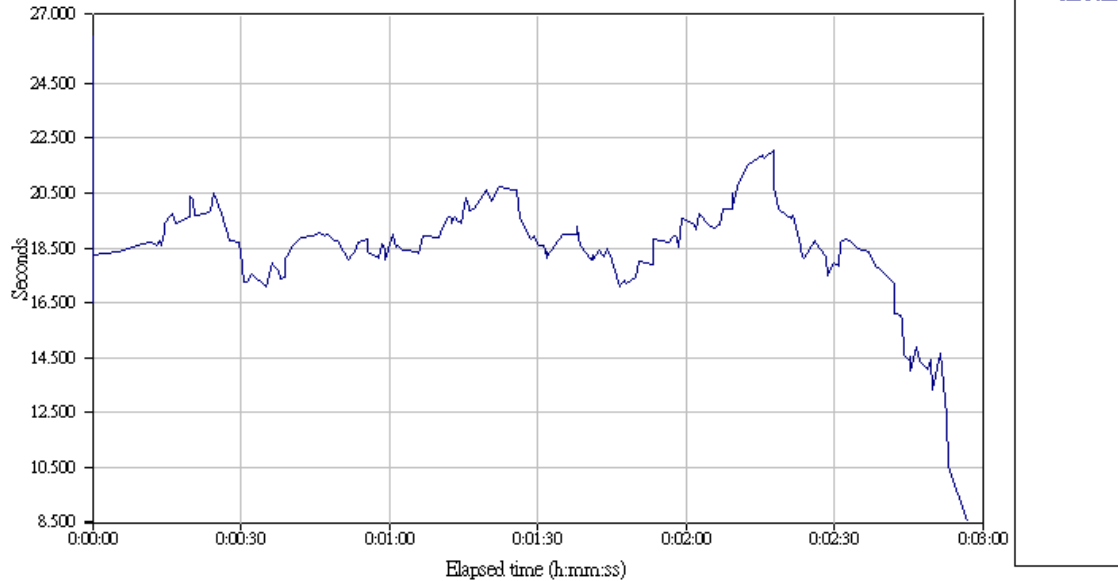
Transaction rate



### Response Time

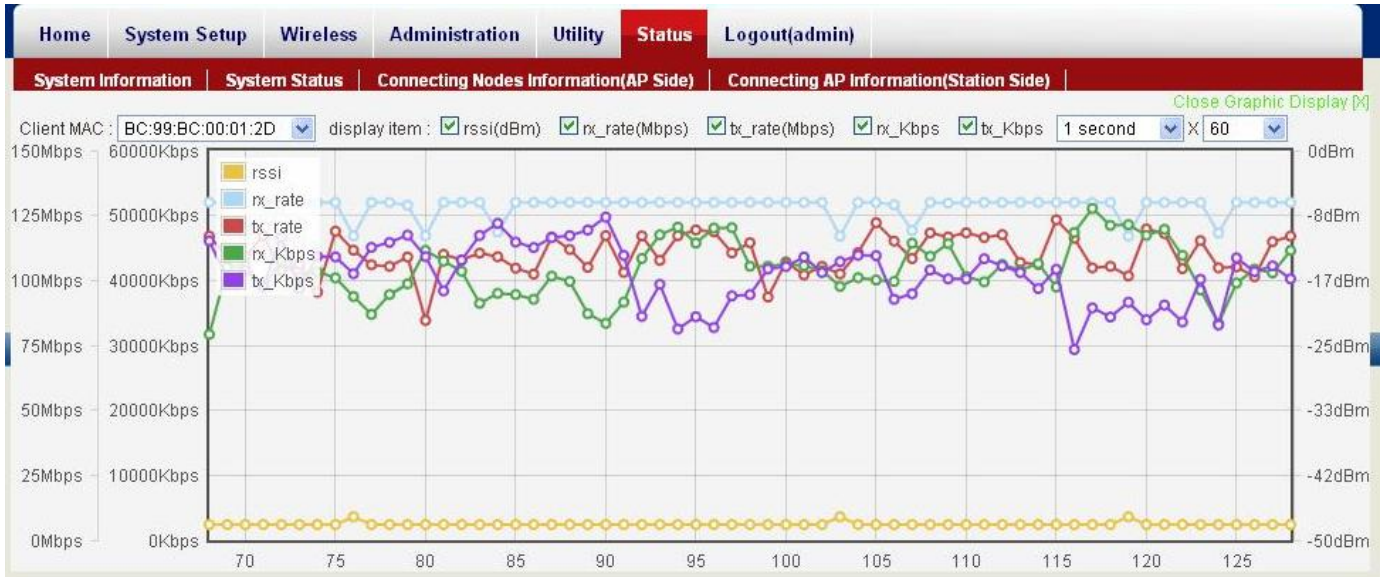
Pair 16	15.139	7.356	27.873
Totals:	16.780	5.254	36.520

Response time

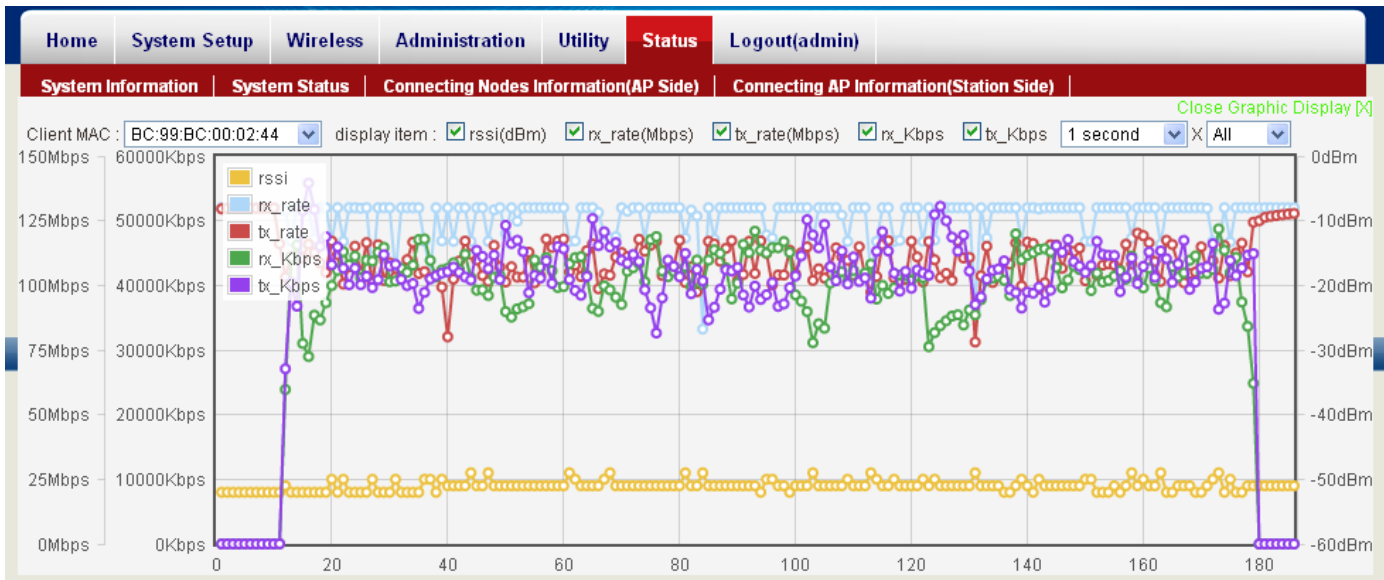




### Point A Screen



### Point D Screen



### Appendix I

無。