



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)

Document ID.

OT-2011-10-0501

Subject

Outdoor Test Report
of
APM-10xR

Revision History

Rev.	Date	Author	Reason for Changes
1.0	Oct. 05, 2011	Jacky Cheng	• Initial draft(English Ver.)
			•
			•



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1.0 Scope

1.1 Introduction

This document primarily demonstrates APM-10xR Outdoor Access Point for outdoor test report.

1.2 Date/Time

- Test Date : 2011/10/05
- Test Time : AM 11:00 ~ PM 16:00

1.3 Location

- Test Point A : Hsinchu High-speed rail station building
- Test Point B : High-speed rail in Hsinchu station of aikou Street
- Test Point C : Hsinchu before Gao Tietou North Bank of the River levee
- Test Point D : Hsinchu South bank of a river

1.4 Equipment

- Outdoor AP Device : APM-103R x 4
- Outdoor Antenna : 5GHz 2x2 MIMO 20dBi Panel Antenna x 6
- Test PC : ASUS A43F Series NB x 2, Toshiba NB x 2
- SW : Windows XP SP3 、IxChariot 5.40
- APM-103R Firmware Version : 1.0(1110.0402)

1.5 Topology

- Multiple Hopping : 3 Hops





2.0 Environment

Of this test, this section describes the environmental condition factor ◦

2.1 GPS Location

Image1 、"Google Earth Location Mark" ◦

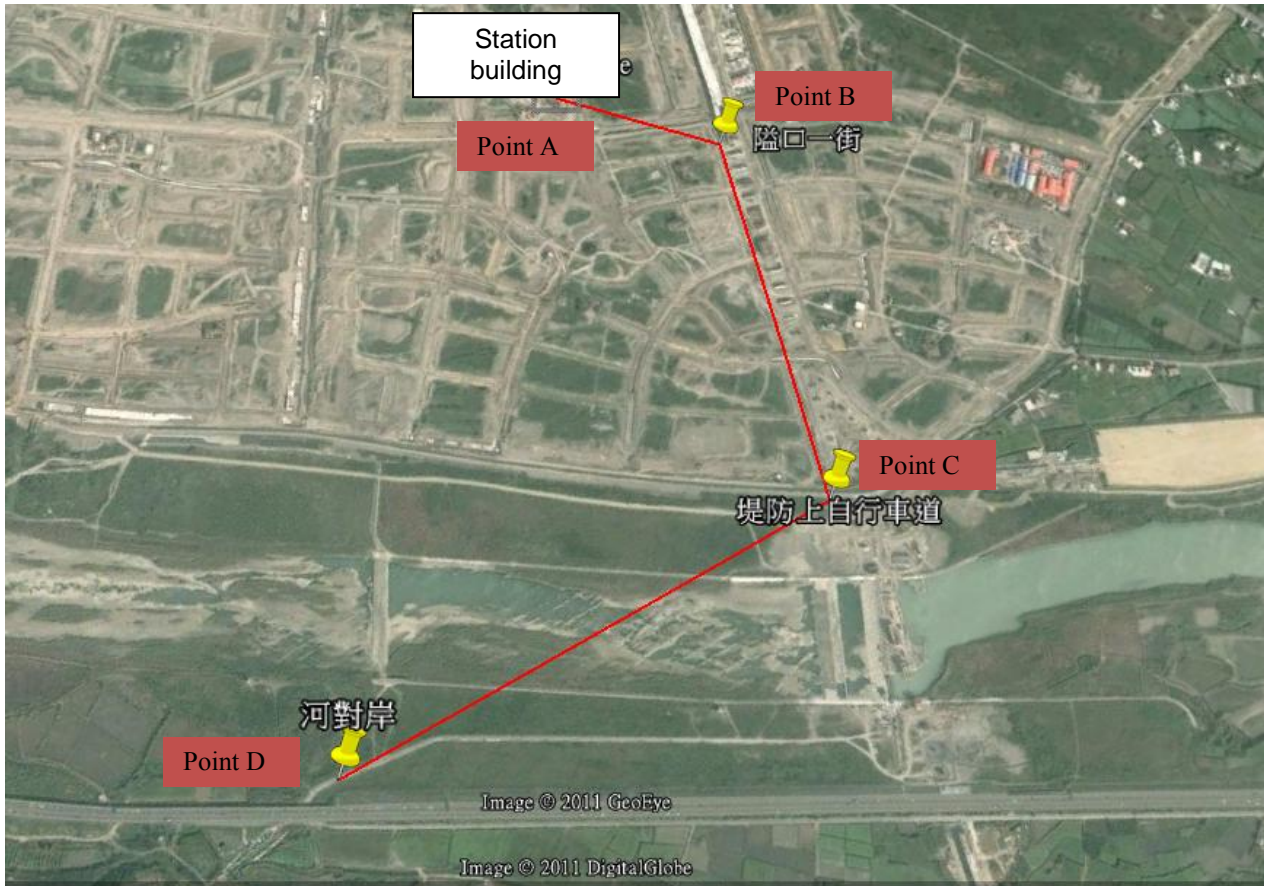
Distance :

Point A to Point B : 320 Meter

Point B to Point C : 710 Meter

Point C to Point D : 930 Meter

Total Distances : 1,960m, 3 Hops





2.2 Fresnel Zone Graph

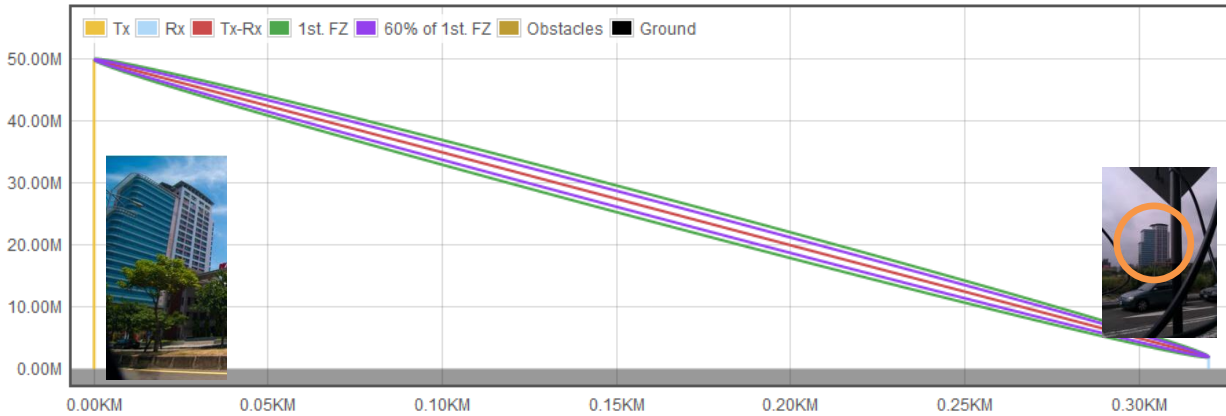
Image2 、"Line of Sight image" ◦

Point A Antenna Height : 50 Meter (14f)

Point B Antenna Height : 2 Meter

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

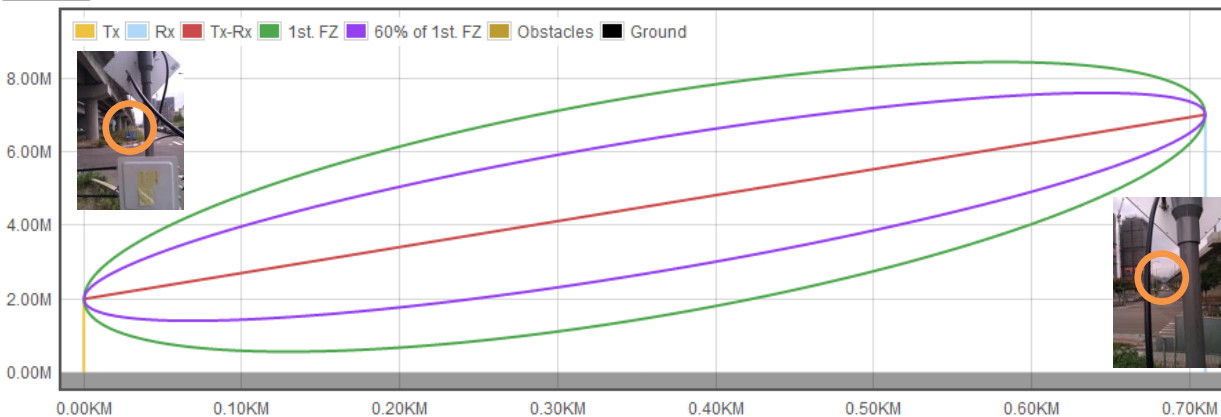


Point B Antenna Height : 2 Meter

Point C Antenna Height : 7 Meter

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



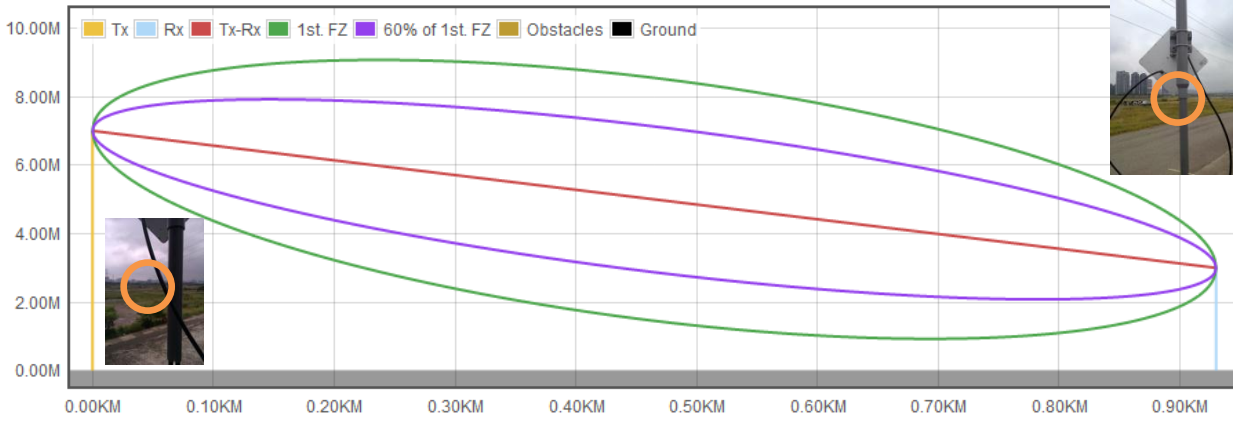


Point C Antenna Height : 7 Meter

Point D Antenna Height : 3 Meter

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

Main Test Item :

TX/RX Antenna Gain is 20dBi

Cable Loss is 2dB

Link	Frequency	RF Tx power @HT40A/N MCS15	Noise Level	Pathloss Theory value	RSSI Theory value
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

Transmitter

Tx Power dBm

Cable loss dB

Antenna Gain dB

Received Sensitivity dBm

Free Space Path

Frequency MHz

Distance KM

Path loss 96.83 dB

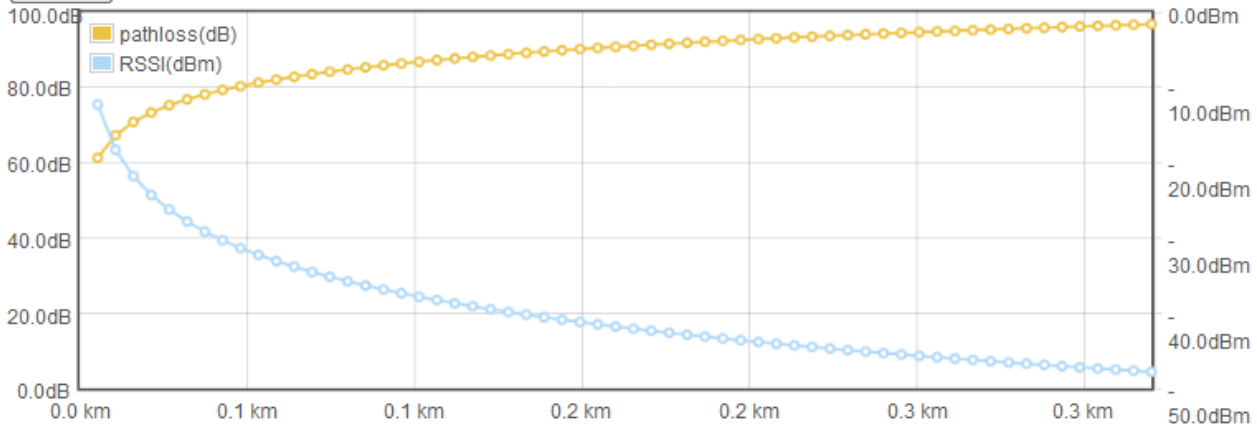
Receiver

RSSI dBm

Cable loss dB

Antenna Gain dB

Margin dB





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

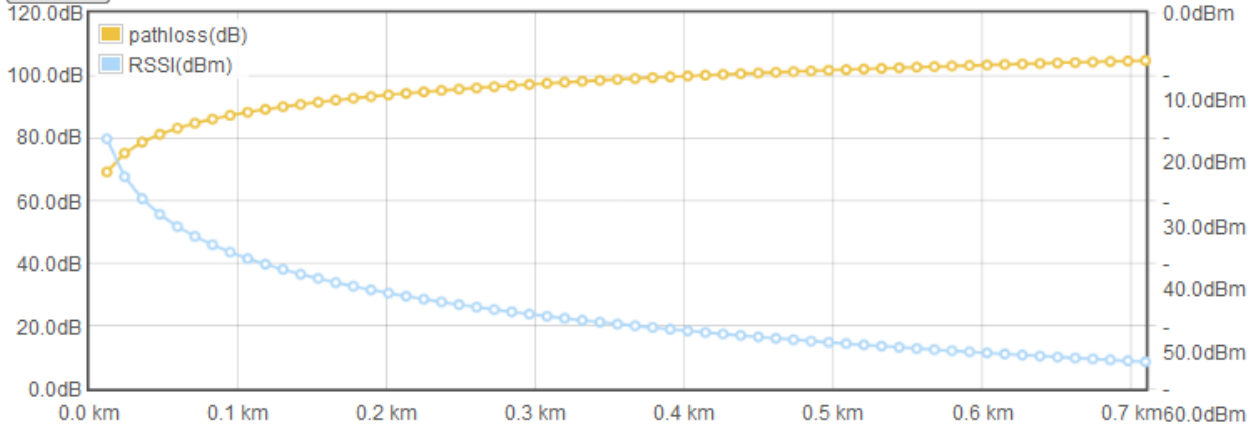
Receiver

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

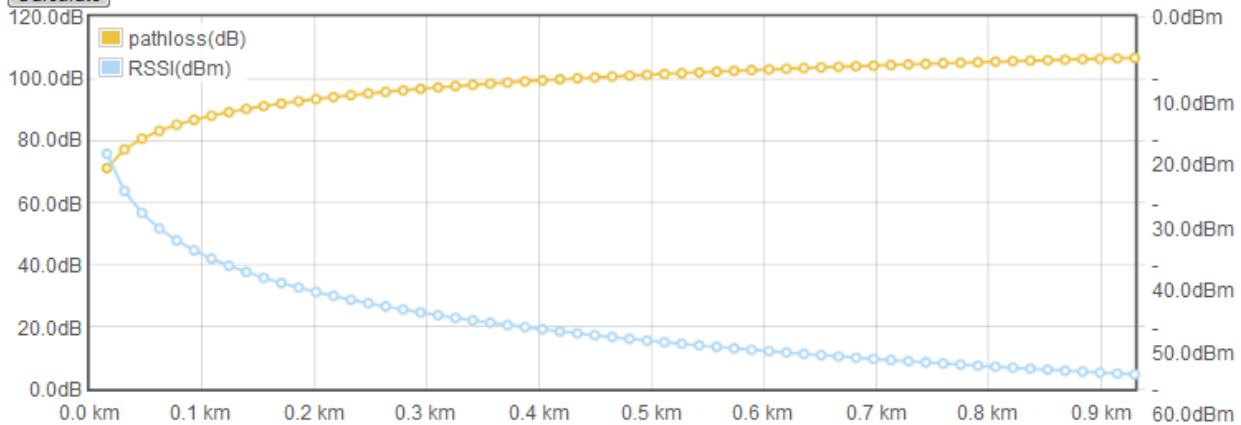
Receiver

RSSI
-57.68 dBm

Cable loss
 dB

Antenna Gain
 dB

Margin
 dB

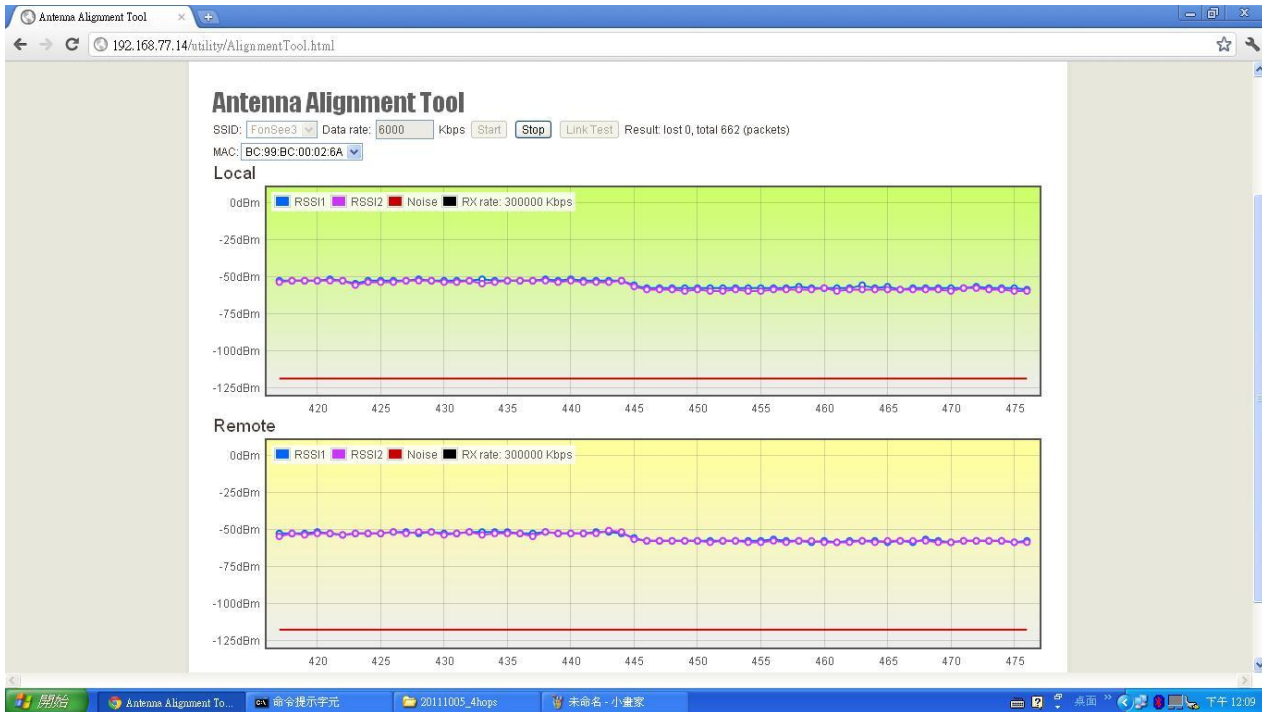




The test to the actual amount of data, respectively :

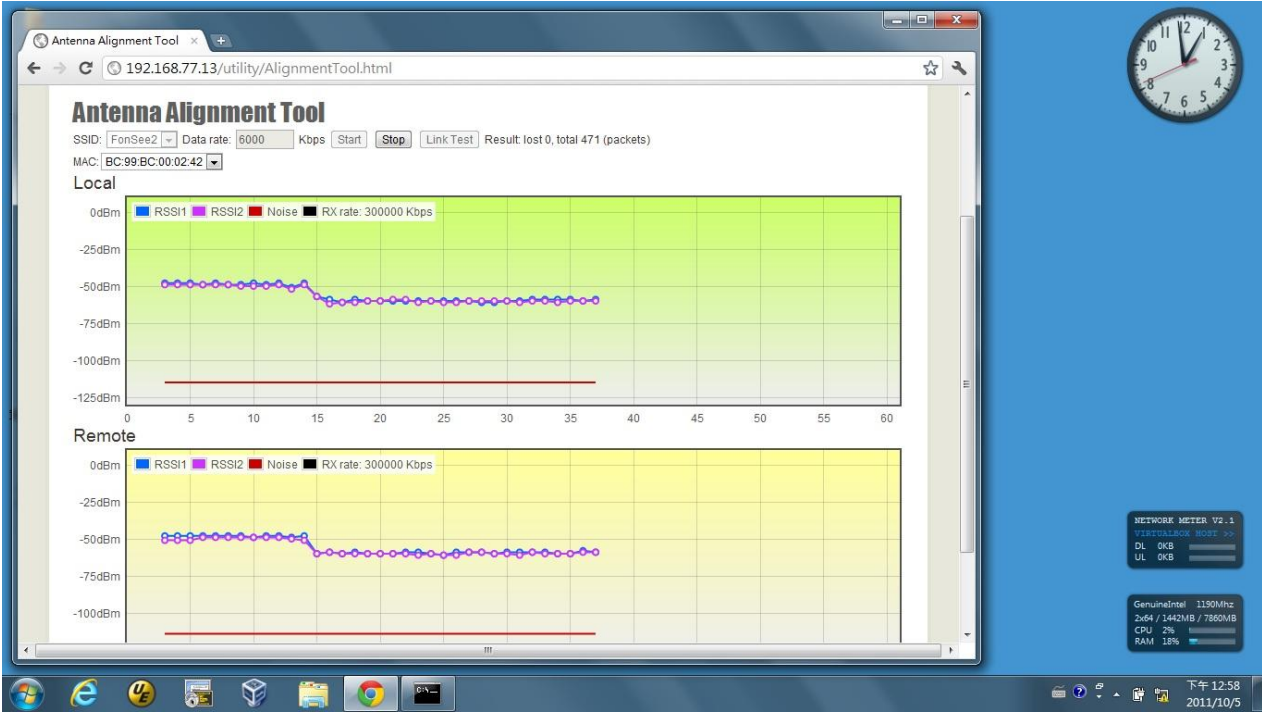
Link	RSSI theory value	RSSI Mensuration Value		Max. Link Rate
		A/B/C	B/C/D	
A to B	-47.8dBm	-53~-56dBm	-52~-54dBm	300Mbps
B to C	-55.7dBm	-58~-60dBm	-58~-60dBm	300Mbps
C to D	-57.7dBm	-61~-65dBm	--60~-62dBm	300Mbps

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

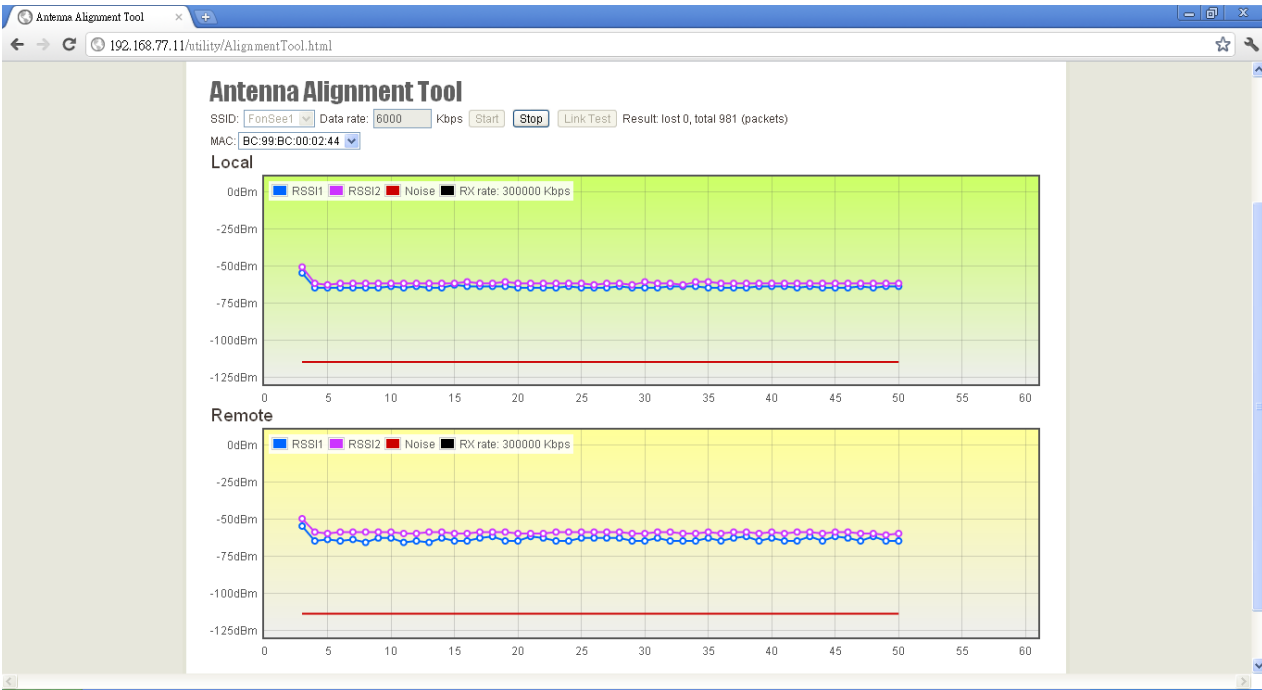




Point B(Local) to Point C(Remote) :



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





3.0 Test Results

Testing some combination of the following parameters :

Distance Parameter Setting is 3Km

IxChariot test pair numbers

Frequency Channel Width

All Test base on IxChariot High Performance script ◦

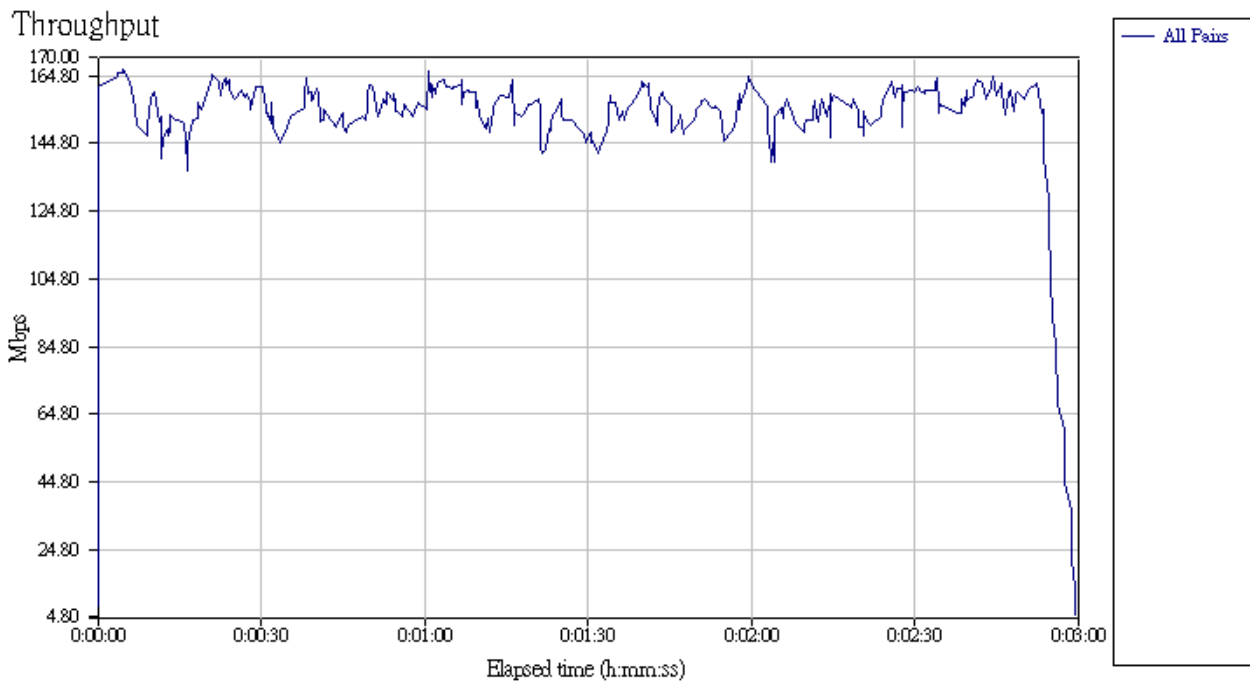
3.1 Test1

2Km / Hops 3 Times / 40MHz Expand Bandwidth/ Throughput 153Mbps

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

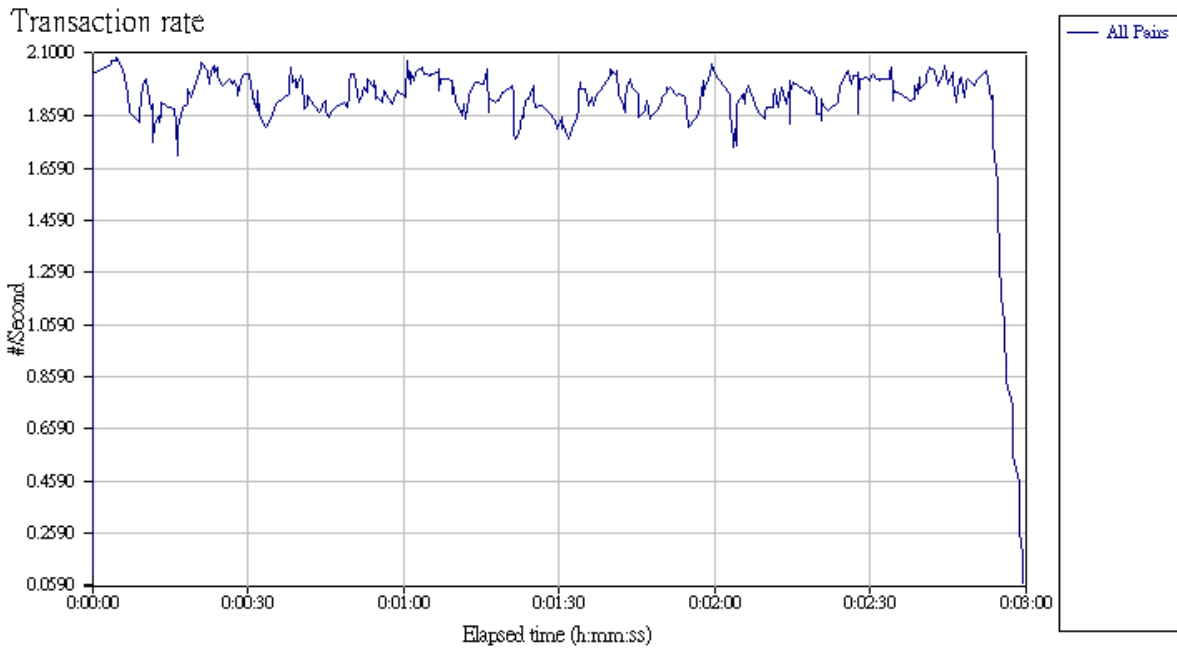
Pair 16	13.519	7.345	25.245
Totals:	153.193	3.596	25.245





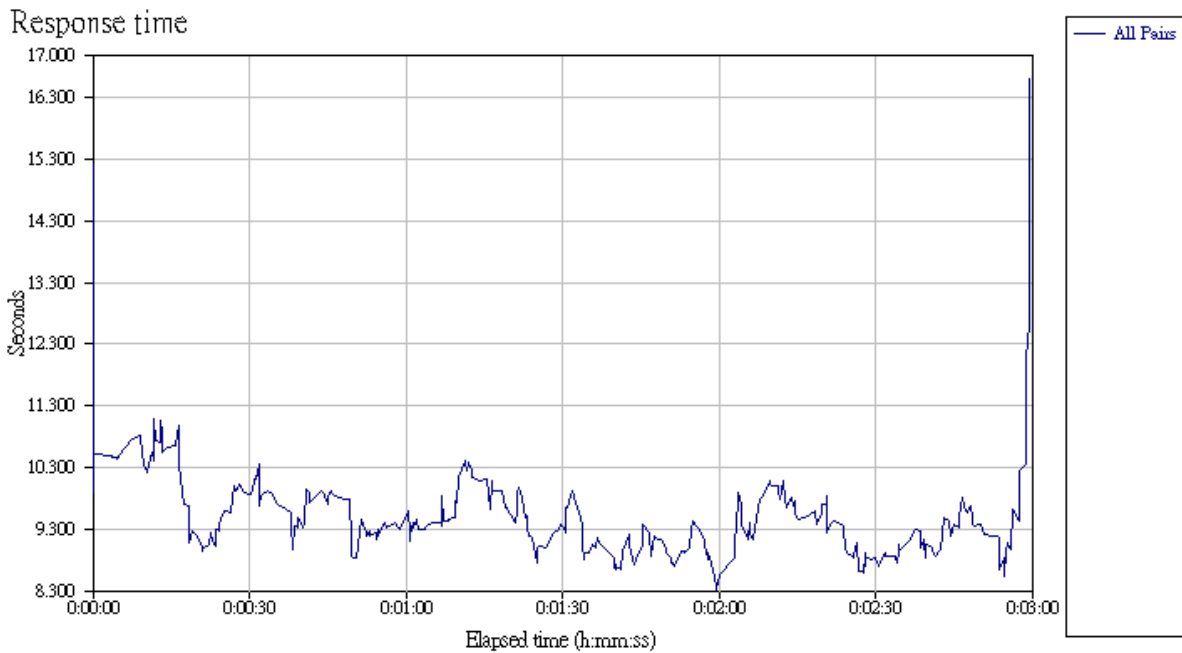
Transaction Rate

Pair 16	0.169	0.092	0.316
Totals:	1.948	0.045	0.316



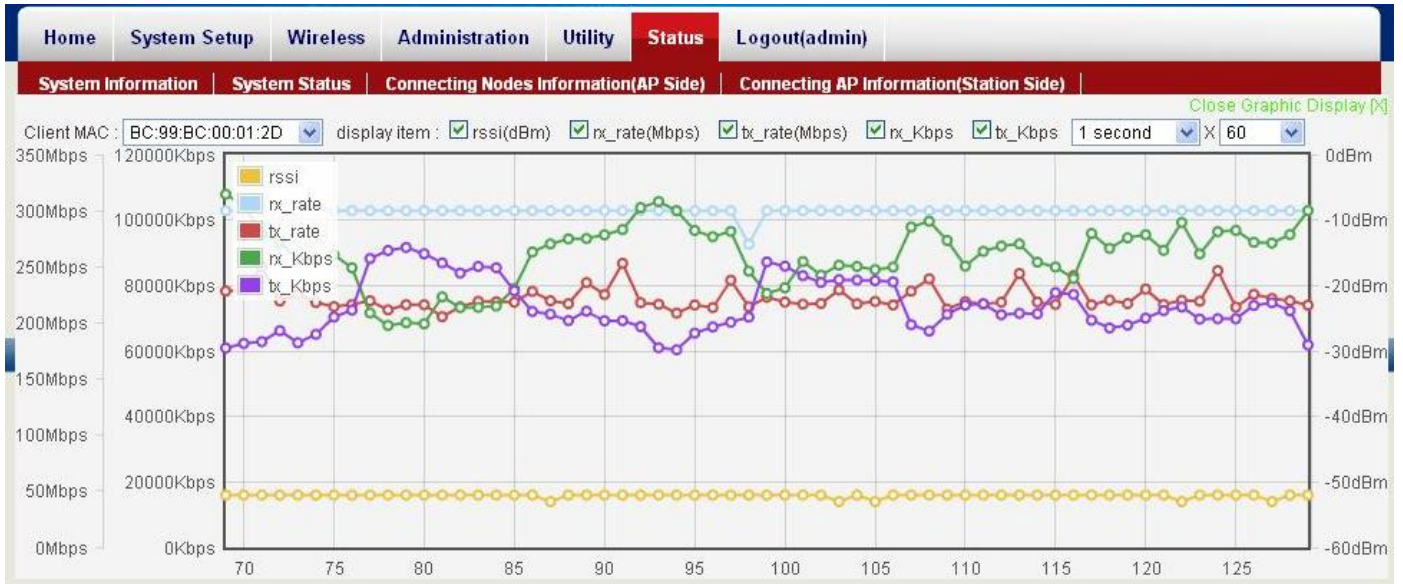
Response Time

Pair 16	5.918	3.169	10.892
Totals:	8.472	3.169	22.244

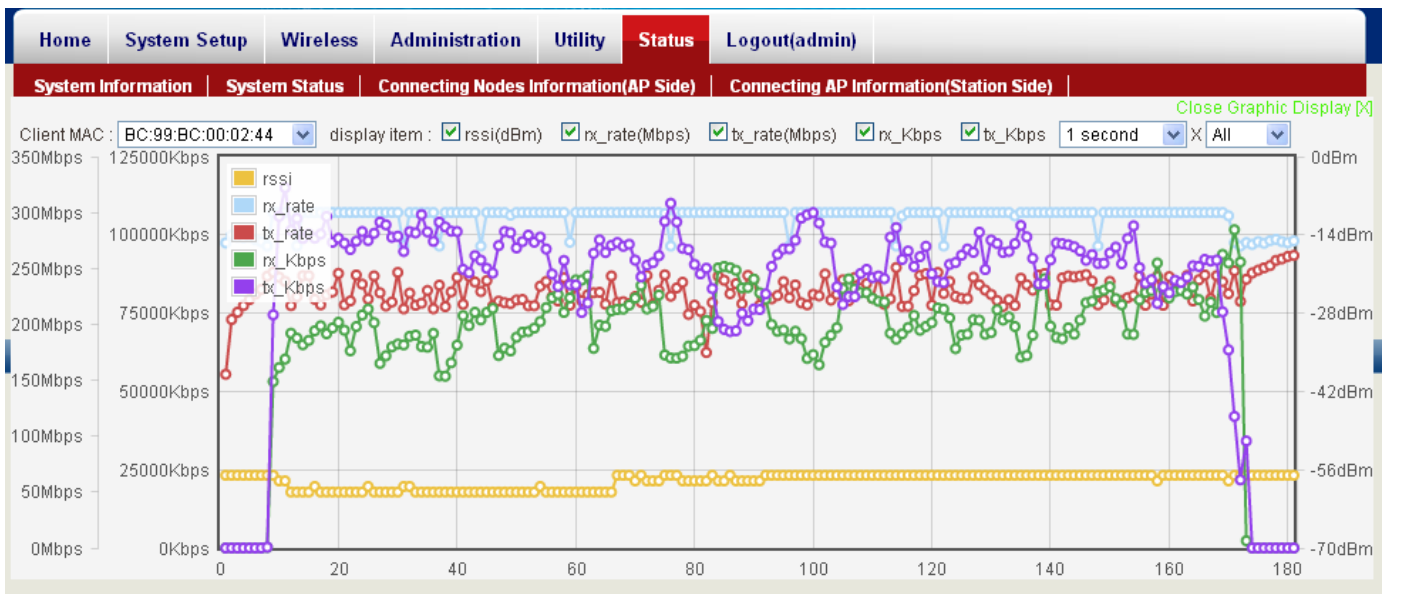




Point A Screen



Point D Screen





3.2 Test2

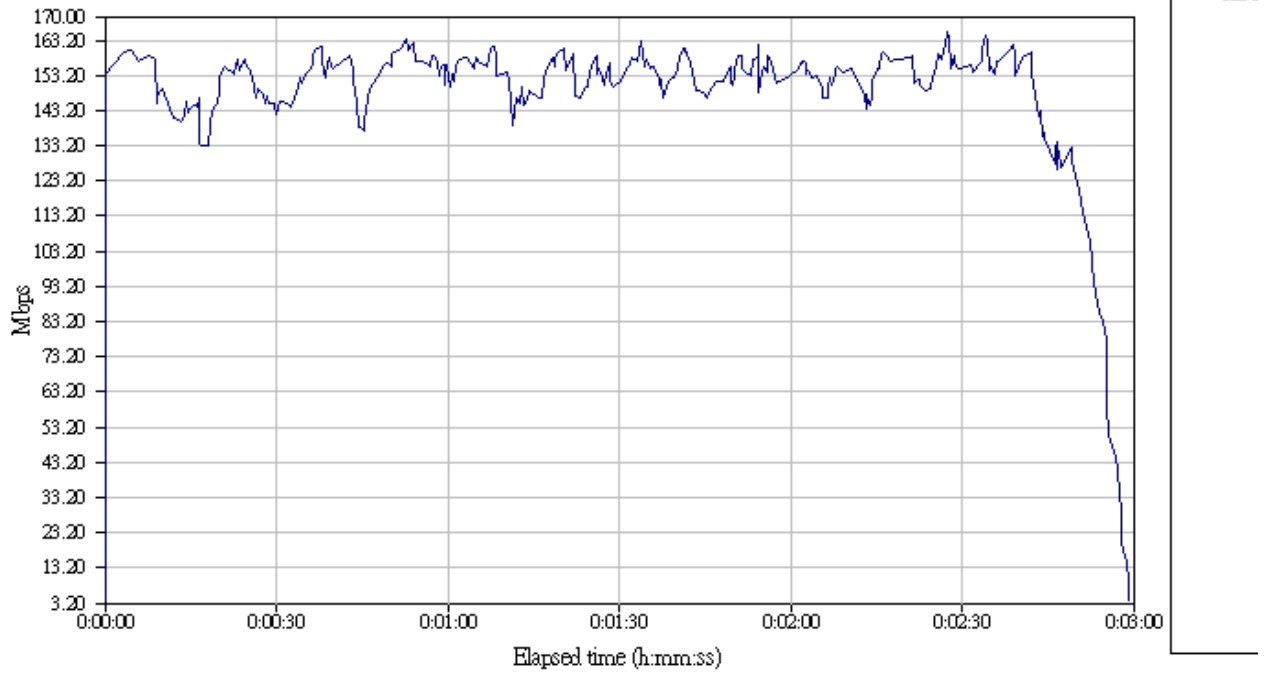
2Km / Hops 3 Times / 40MHz Expand Bandwidth/ Throughput 148Mbps

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

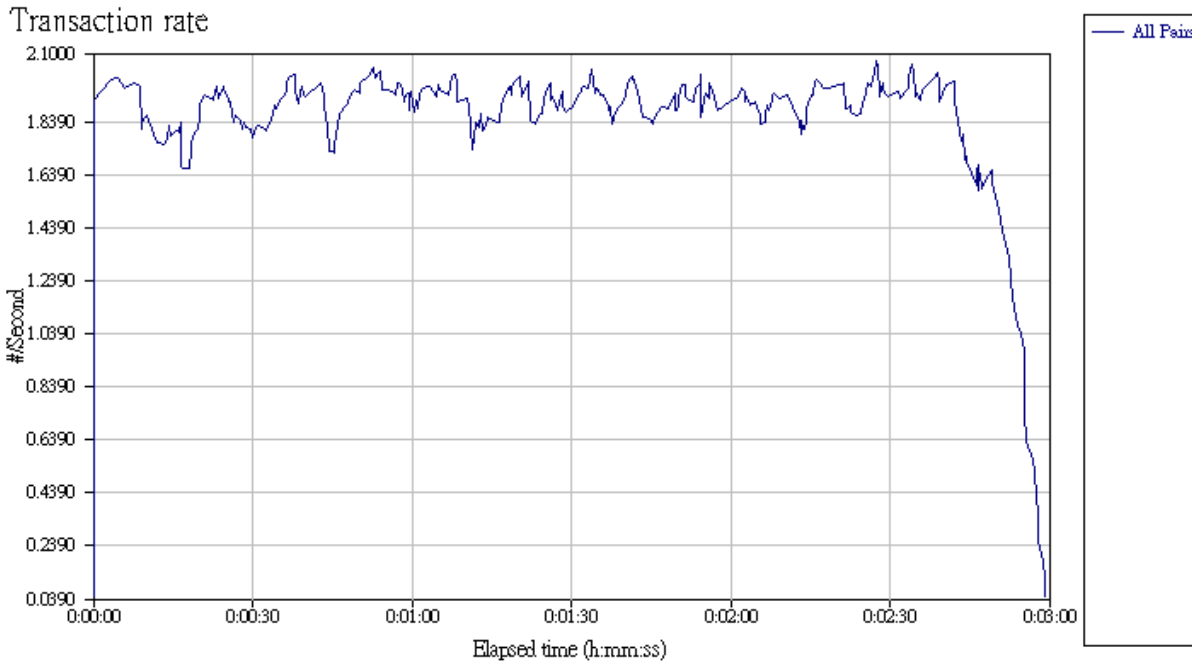
Throughput





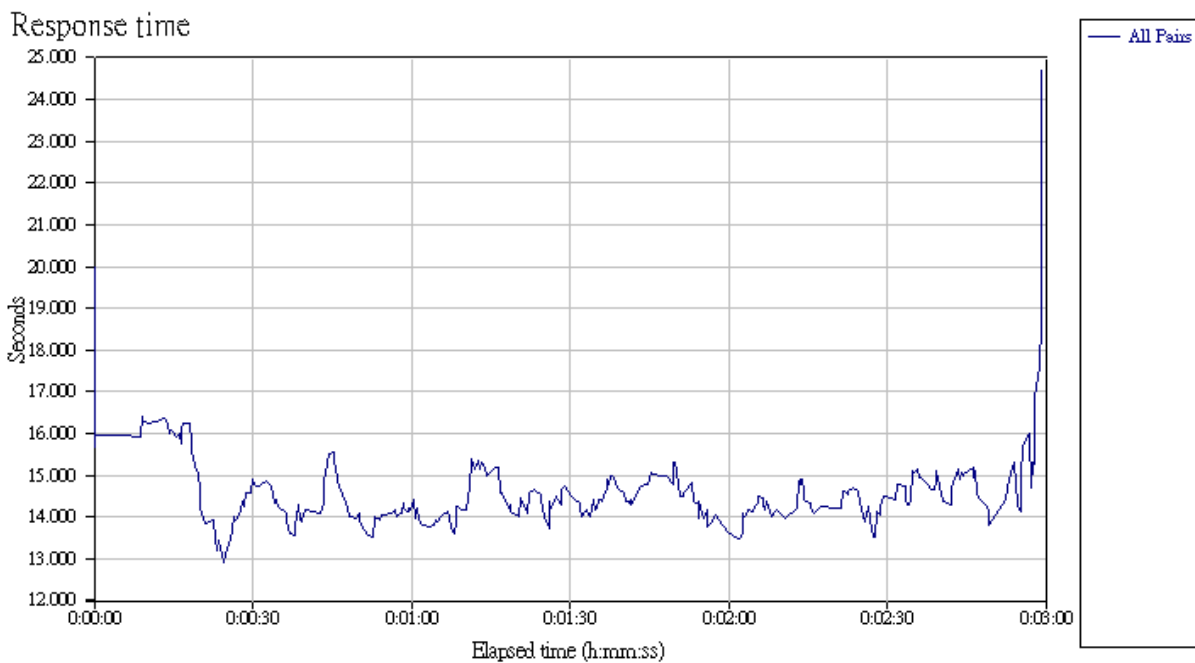
Transaction Rate

Pair 24	0.091	0.051	0.189
Totals:	1.915	0.035	0.380



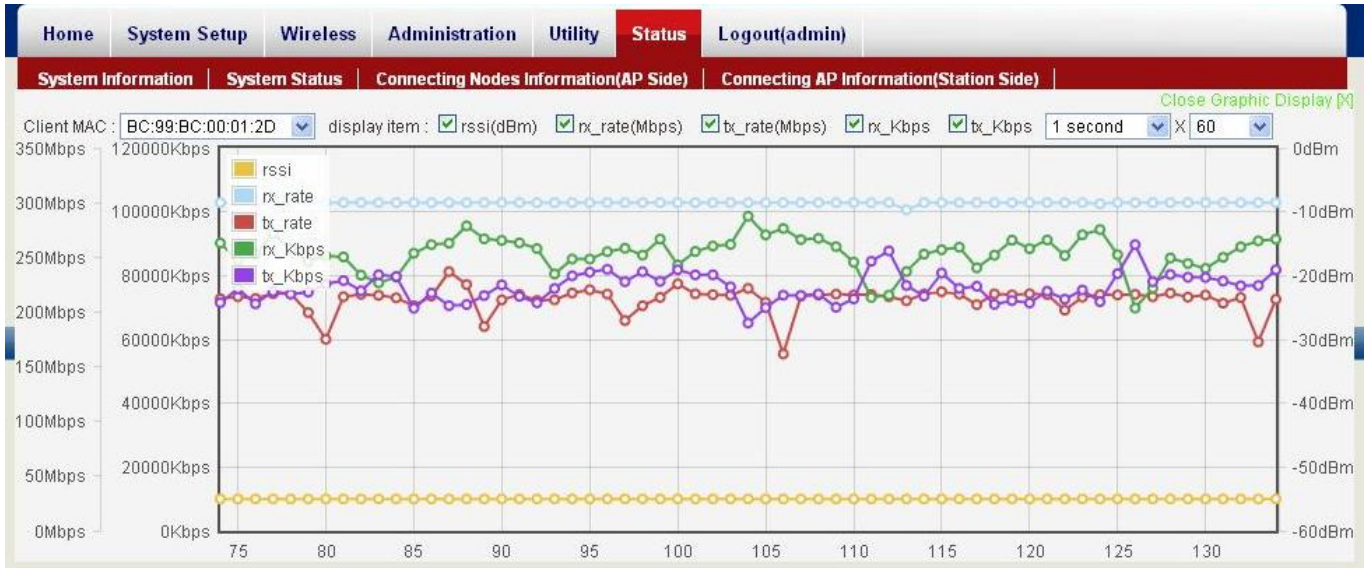
Response Time

Pair 24	10.949	5.292	19.681
Totals:	12.851	2.631	28.197

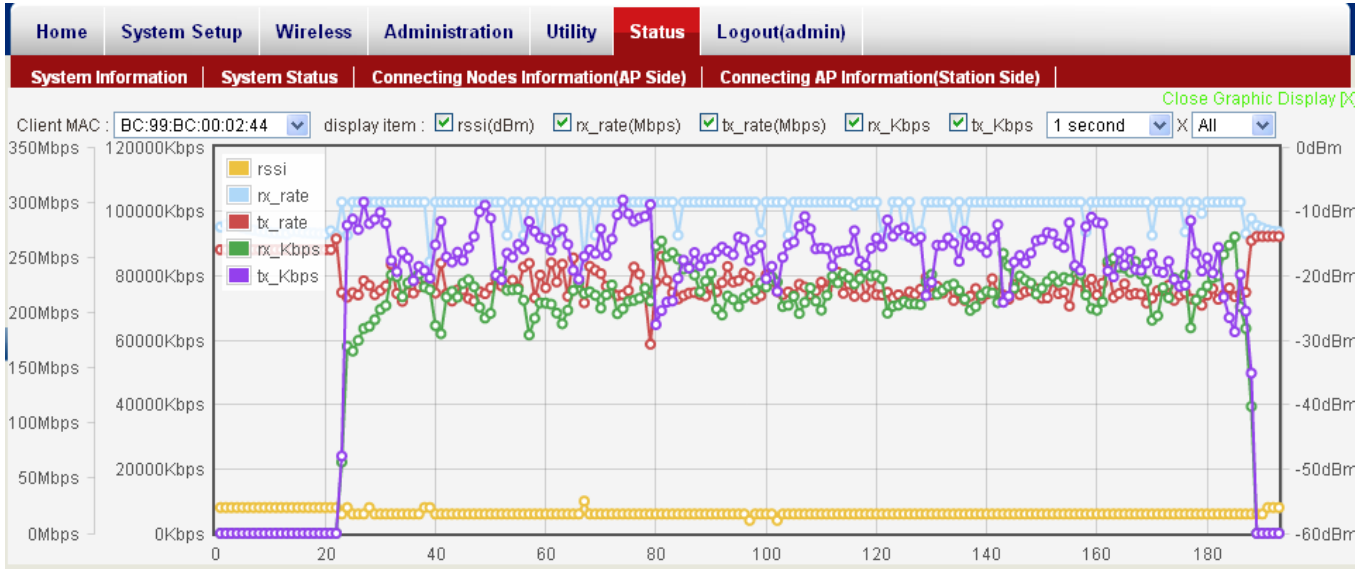




Point A Screen



Point D Screen





3.3 Test3

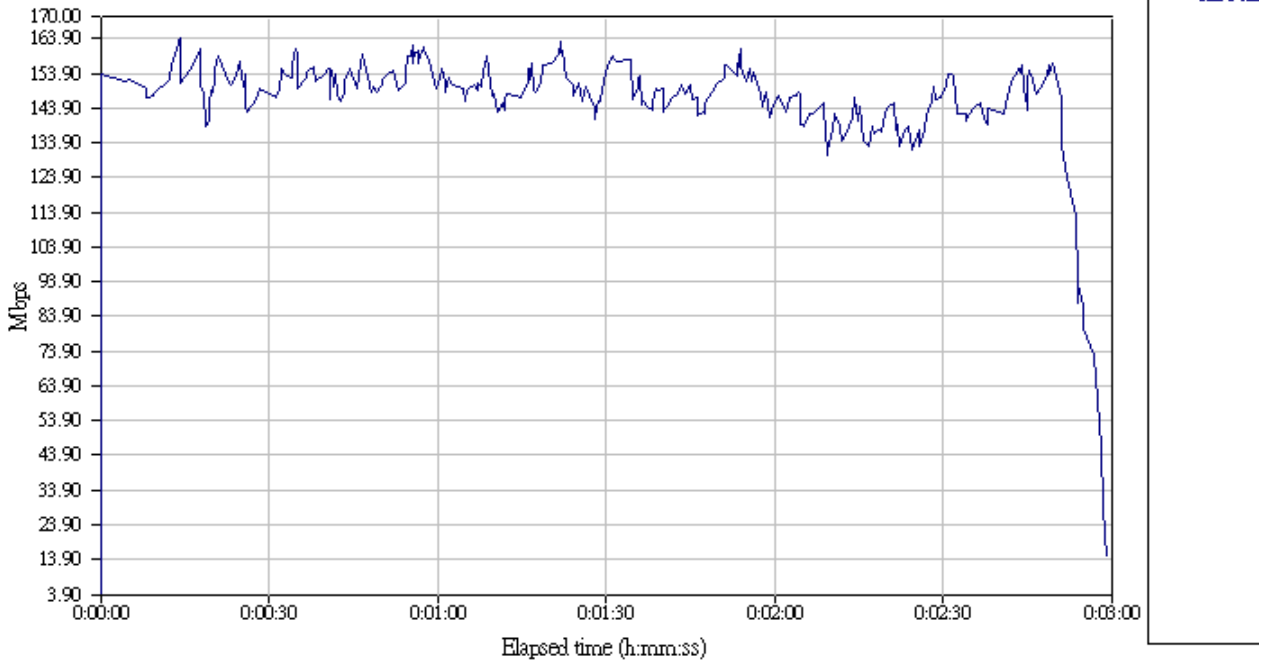
2Km / Hops 3 Times / 40MHz Expand Bandwidth/ Throughput 146Mbps

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

Throughput

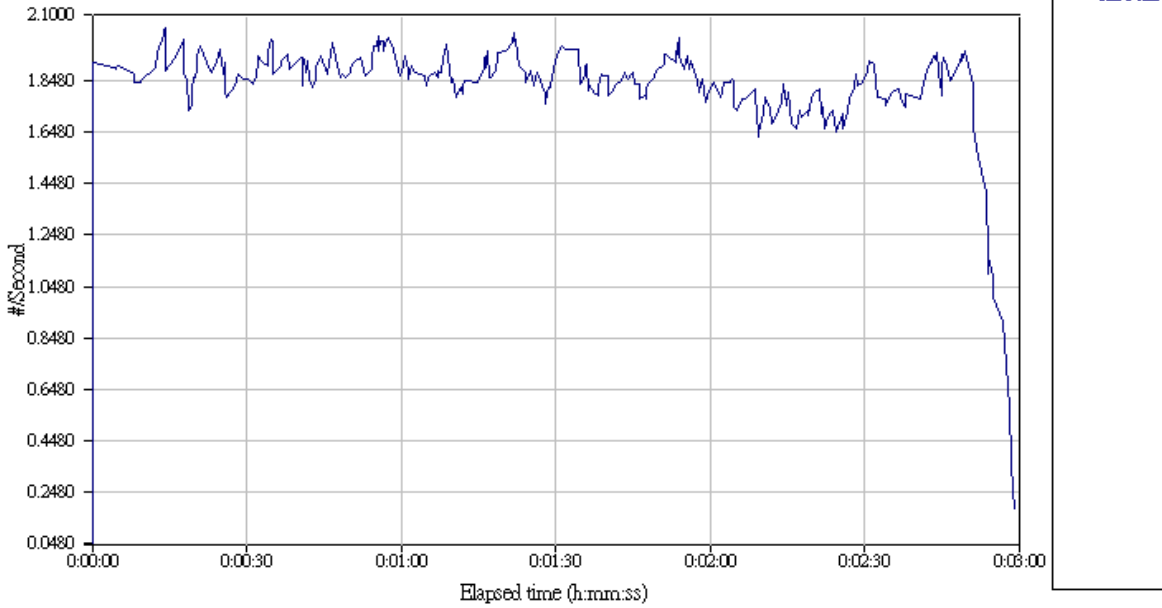




Transaction Rate

Pair 16	0.140	0.084	0.255
Totals:	1.877	0.047	0.255

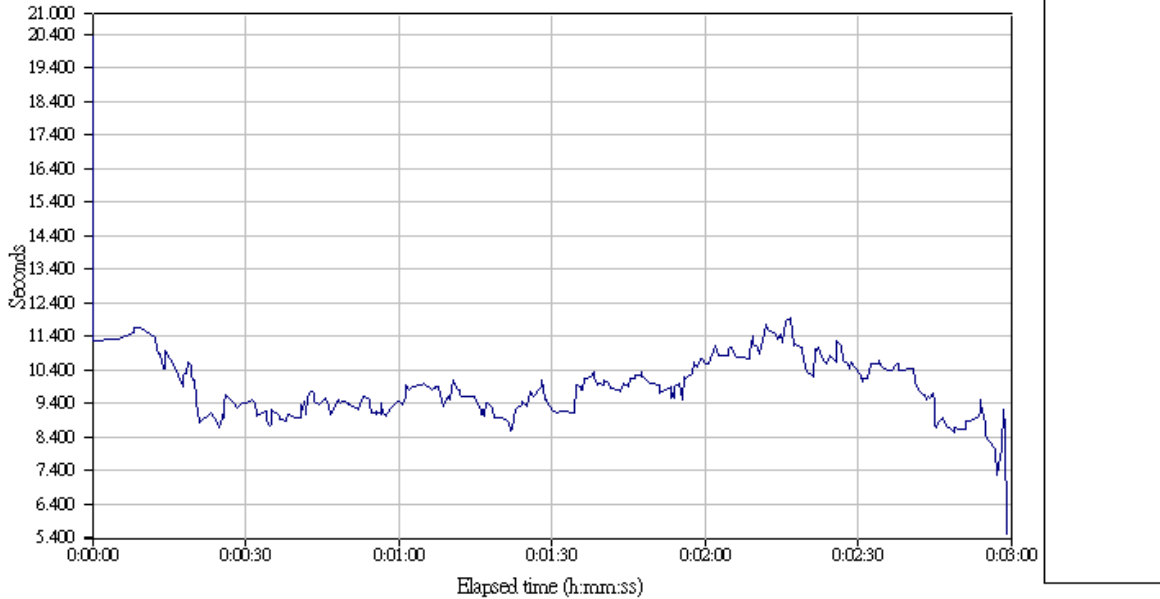
Transaction rate



Response Time

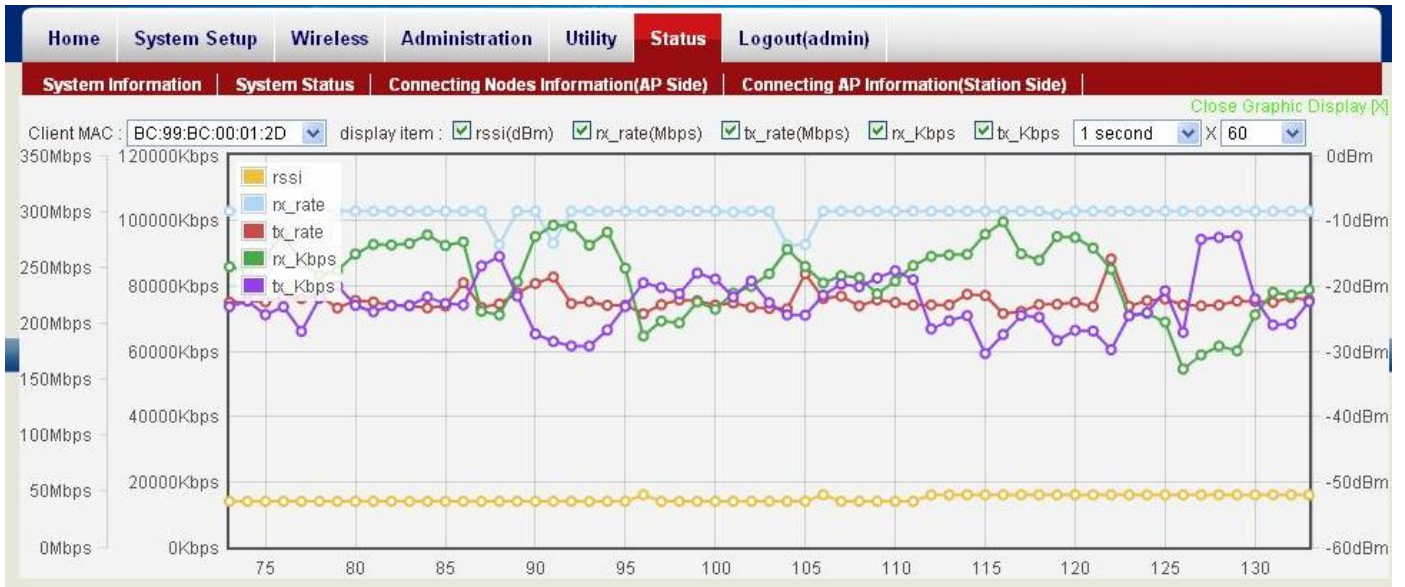
Pair 16	7.131	3.915	11.893
Totals:	8.693	3.915	21.389

Response time

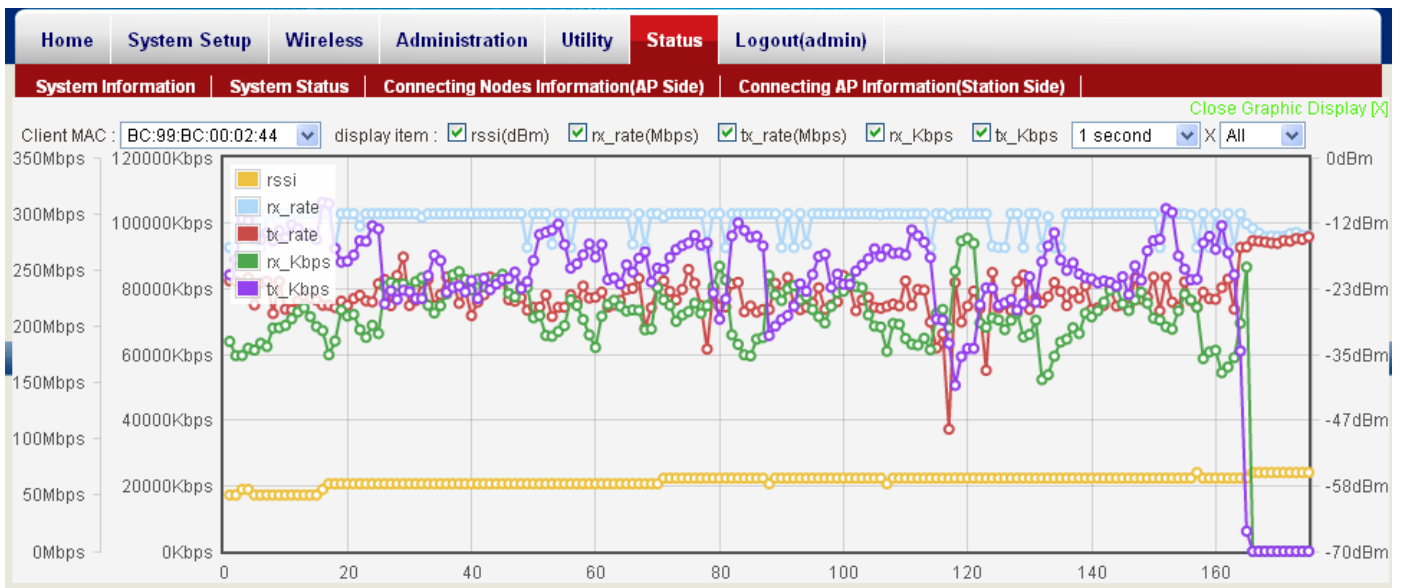




Point A Screen



Point D Screen





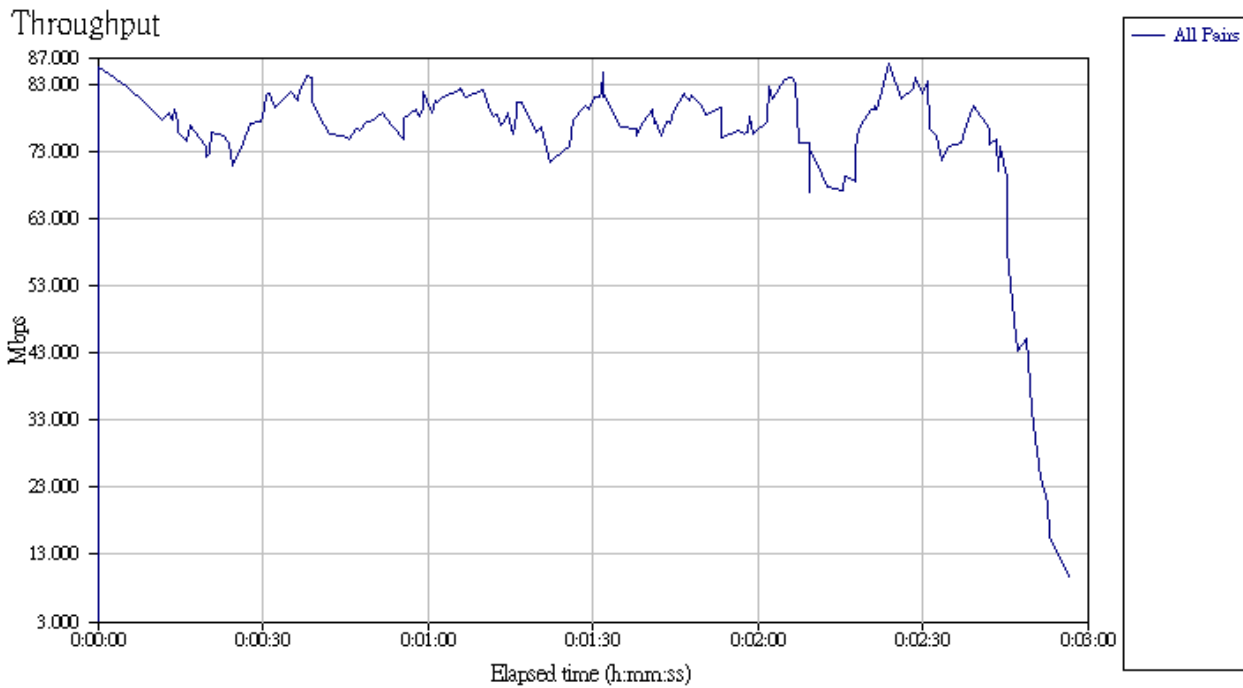
3.4 Test4

2Km / Hops 3 Times / 20MHz One Bandwidth/ Throughput 74.5Mbps

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

Throughput

Pair 16	5.284	2.870	10.875
Totals:	74.781	2.191	15.226

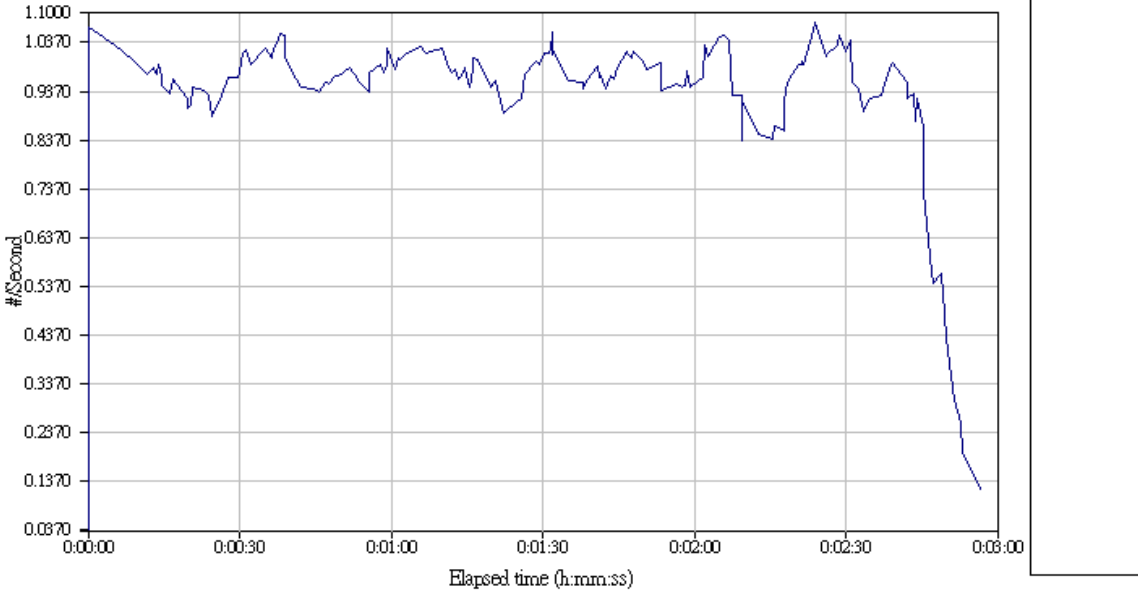




Transaction Rate

Pair 16	0.066	0.036	0.136
Totals:	0.990	0.027	0.190

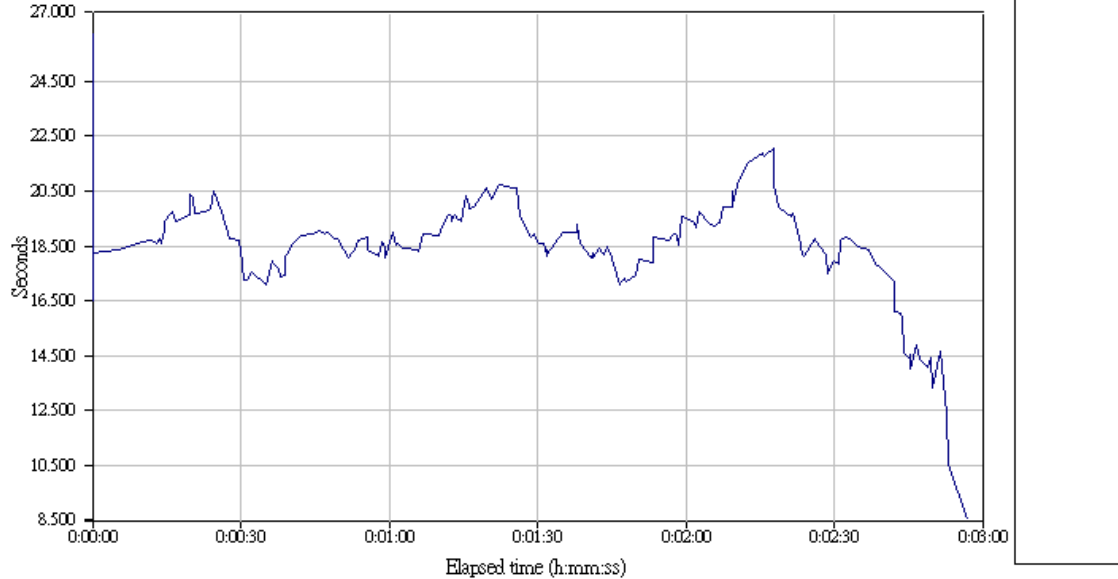
Transaction rate



Response Time

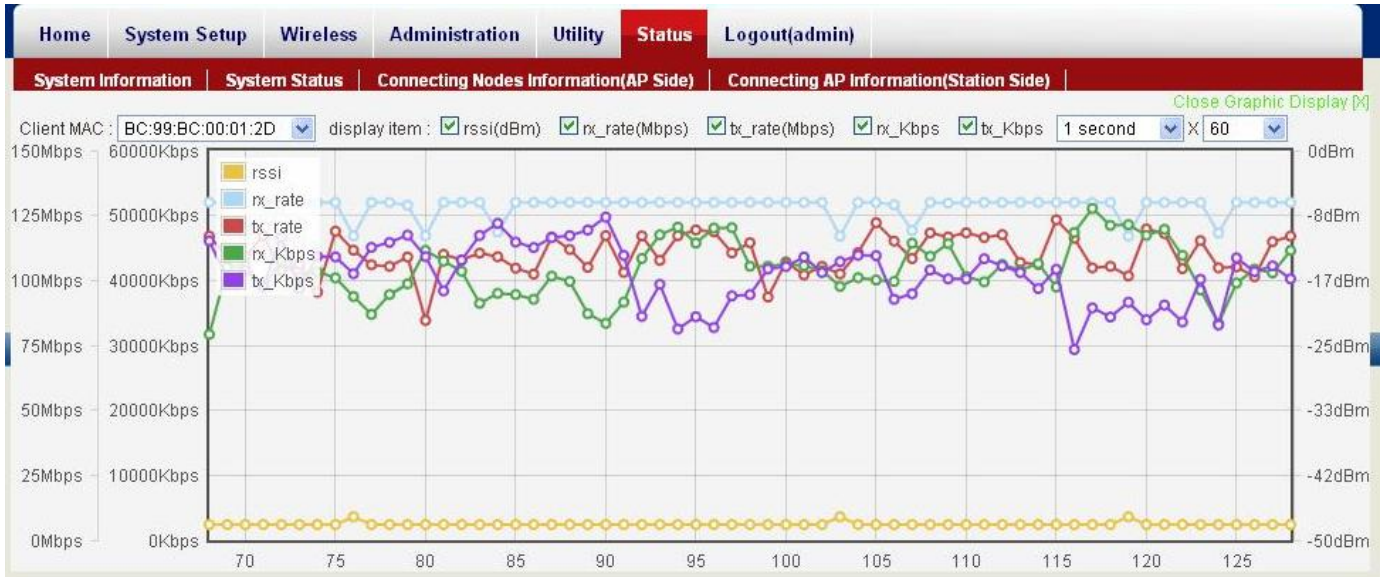
Pair 16	15.139	7.356	27.873
Totals:	16.780	5.254	36.520

Response time

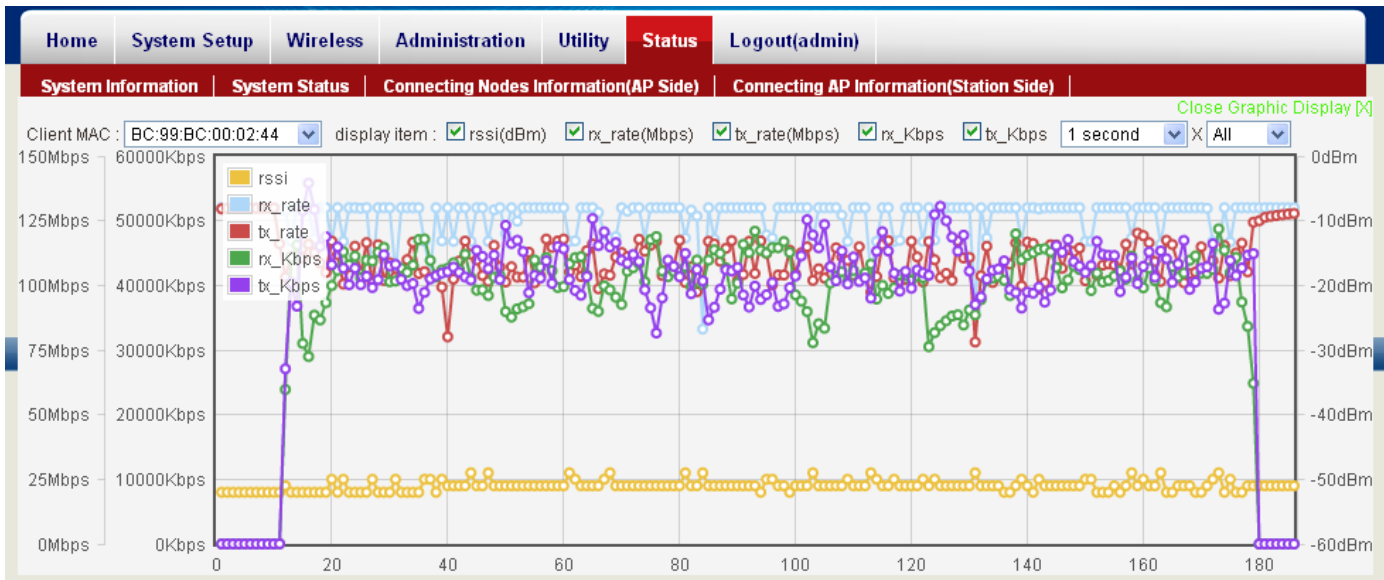




Point A Screen



Point D Screen



Appendix I

Non °