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| <input type="checkbox"/> Requirement (RQ)                                        | <input type="checkbox"/> External Specification (ES) |
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| <input type="checkbox"/> Test Plan (TP)                                          | <input type="checkbox"/> Release Note (RN)           |
| <input type="checkbox"/> Bug Report (BR)                                         | <input type="checkbox"/> Training Material (TM)      |
| <input checked="" type="checkbox"/> Other <u>Outdoor Test Report 15.8KM</u> (OT) |                                                      |

**Document ID.**

OT-2011-10-3101

**Subject**

Outdoor Test Report  
of  
APM-10xRH

**Revision History**

| Rev. | Date          | Author      | Reason for Changes            |
|------|---------------|-------------|-------------------------------|
| 1.0  | Oct. 31, 2011 | Jacky Cheng | • Initial draft(English Ver.) |
|      |               |             | •                             |
|      |               |             | •                             |



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## 1.0 Scope

### 1.1 Introduction

This document primarily demonstrates IO-Power APM-10xRH Outdoor Access Point for outdoor test report °

### 1.2 Date/Time

- Test Date : 2011/10/27
- Test Time : AM 10:00 ~ PM 18:00

### 1.3 Location

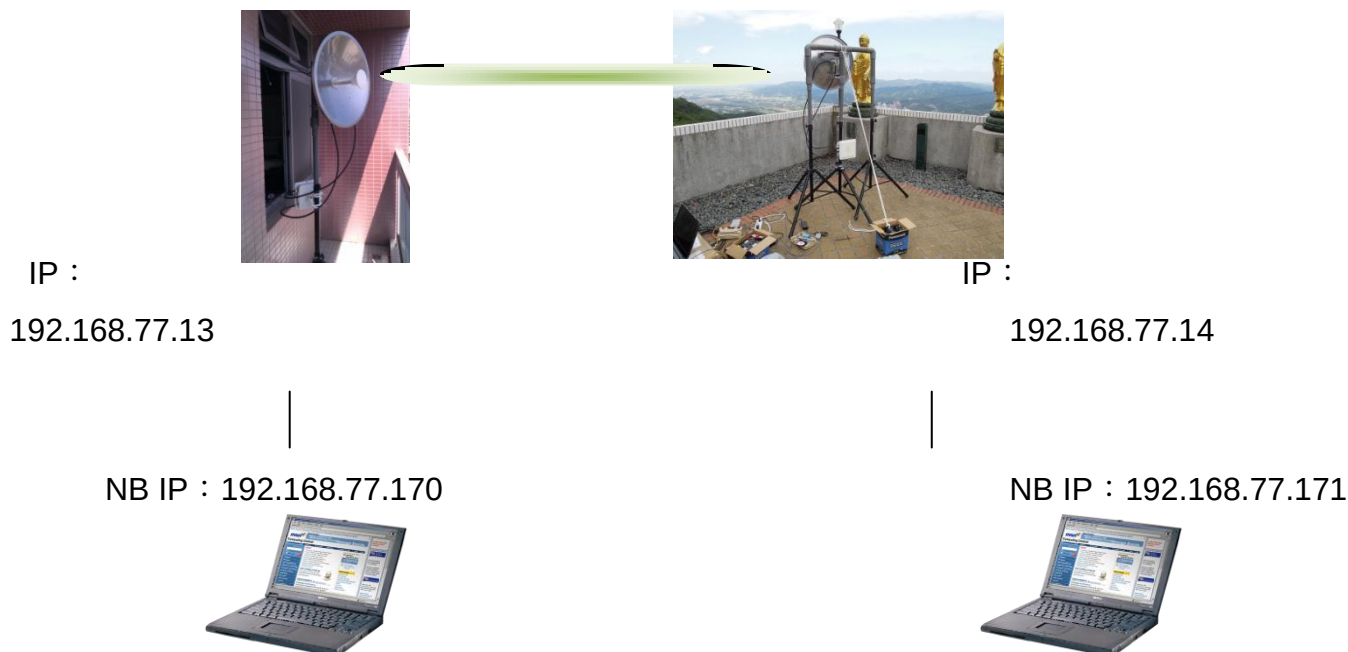
- Test Point A : The high-speed rail station building
- Test Point B : Hengshan Township Lok Sin Tong

### 1.4 Equipment

- Outdoor AP Device : APM-103RH x 2
- Outdoor Antenna : 5GHz 2x2 MIMO 29dBi Dish Antenna x 2
- Test PC : ASUS A43F Series NB x 2
- SW : Windows XP SP3 、IxChariot 5.40
- APM-103RH Firmware Version : 1.0(1110.2601)

### 1.5 Topology

- Point to Point





## 2.0 Environment

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

### 2.1 GPS Location

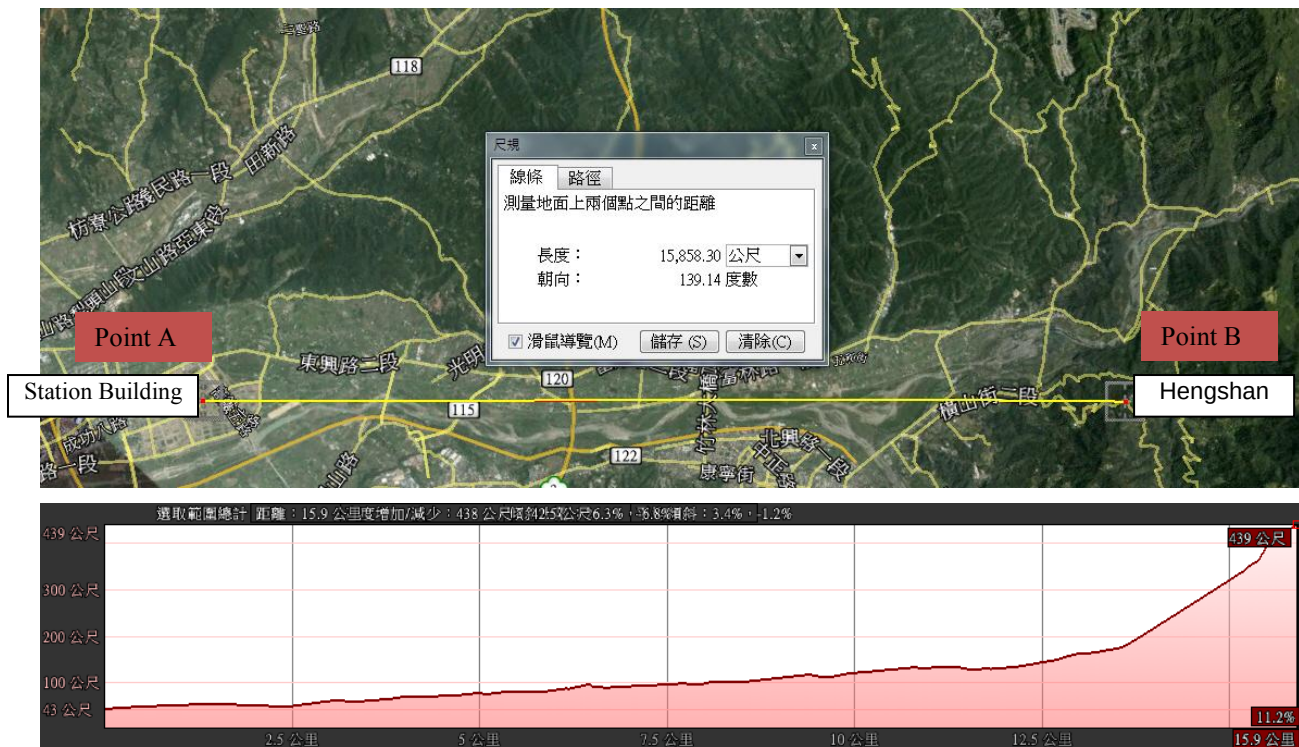
Image1、“Google Earth GPS Location Mark”。

Distance：

Point A- The high-speed rail station building (N24°48'26.40" E121°2'12.72")

Point B- Hengshan Township Lok Sin Tong (N24°41'57.57" E121°8'22.75")

Distance：15,858m



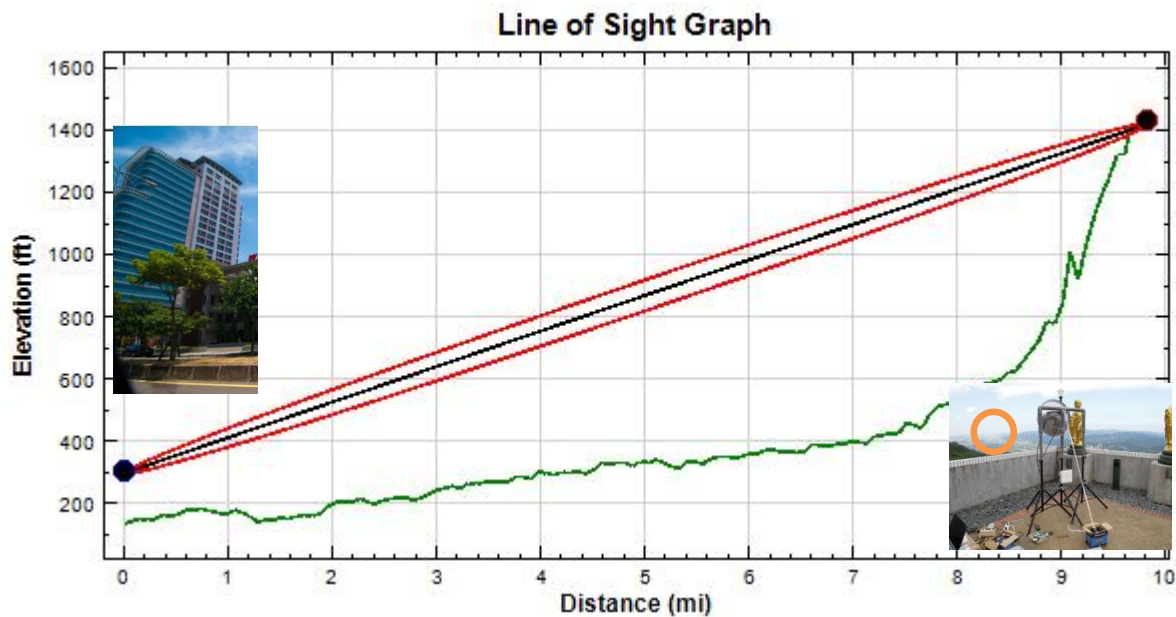


## 2.2 Fresnel Zone Graph

Image2 、"Line of Sight" 。

Point A Antenna Height : 170ft (14f)

Point B Antenna Height : 23ft (Hengshan Township Lok Sin Tong)



|   |                                                                                      |                                                           |                              |
|---|--------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------|
| — | Elevation Data Line Plot                                                             |                                                           |                              |
| — | Line of Sight Line Plot (Adjusted to Consider Obstruction Caused by Earth Curvature) |                                                           |                              |
| — | First Fresnel Zone Line Plot                                                         |                                                           |                              |
| ● | Point 1 Terrain Elevation: 137.80 ft<br>Latitude: 24.807500000077                    | TX/RX Elevation: 170.00 ft<br>Longitude: 121.035833333319 | Total Elevation: 307.80 ft   |
| ● | Point 2 Terrain Elevation: 1,407.48 ft<br>Latitude: 24.700000000120                  | TX/RX Elevation: 23.00 ft<br>Longitude: 121.139166666612  | Total Elevation: 1,430.48 ft |

Earth Curvature Adjustment: ☐ Off ☒ On

Saved Line of Sight Profile Name: 15\_9Km  
Approx. Distance Between Points: 9.82 Miles  
Earth Obstruction Adjusted For: 12.06 Feet  
First Fresnel Zone Peak Radius: 49.45 Feet  
Transmission Frequency: 5,220.000000 MHz



## 2.3 Spectrum

Main Test Item :

TX/RX Antenna Gain is 29dBi

Cable Loss is 2dB

| Frequency | RF Tx power<br>@HT20A/N<br>MCS15<br>HighPower /<br>Normal Power | Noise<br>Level | Pathloss<br>Theory<br>value | RSSI Theory<br>value<br>High Power /<br>Normal Power | Point A<br>RSSI<br>Mensuration<br>value<br>High Power /<br>Normal Power | Point B<br>RSSI<br>Mensuration<br>value<br>High Power /<br>Normal Power |
|-----------|-----------------------------------------------------------------|----------------|-----------------------------|------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 5,180MHz  | 18dBm /<br>16dBm                                                | -113dBm        | 130.8dB                     | -58.8dBm /<br>-60.8dBm                               | -60~-62dBm /<br>-66~-67dBm                                              | -60~-62dBm /<br>-66~-67dBm                                              |
| 5,500MHz  | 18dBm /<br>14dBm                                                | -110dBm        | 131.3dB                     | -59.3dBm /<br>-63.3dBm                               | -60~-61dBm /<br>-65~-67dBm                                              | -60~-62dBm /<br>-66~-67dBm                                              |
| 5,785MHz  | 17dBm /<br>14dBm                                                | -108dBm        | 131.8dB                     | -60.8dBm /<br>-63.8dBm                               | -62~-64dBm /<br>-63~-65dBm                                              | -62~-63dBm /<br>-63~-65dBm                                              |

| Frequency | RF Tx power<br>@HT40A/N<br>MCS15<br>HighPower /<br>Normal Power | Noise<br>Level | Pathloss<br>Theory<br>value | RSSI Theory<br>value<br>High Power /<br>Normal Power | Point A<br>RSSI<br>Mensuration<br>value<br>High Power /<br>Normal Power | Point B<br>RSSI<br>Mensuration<br>value<br>High Power /<br>Normal Power |
|-----------|-----------------------------------------------------------------|----------------|-----------------------------|------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 5,190MHz  | 17dBm /<br>13dBm                                                | -112dBm        | 130.8dB                     | -59.8dBm /<br>-63.8dBm                               | -65~-66dBm /<br>-72~-73dBm                                              | -65~-68dBm /<br>-71~-73dBm                                              |
| 5,510MHz  | 17dBm /<br>13dBm                                                | -111dBm        | 131.3dB                     | -60.3dBm /<br>-64.3dBm                               | -64~-66dBm /<br>-73~-75dBm                                              | -64~-65dBm /<br>-72~-76dBm                                              |
| 5,795MHz  | 16dBm /<br>13dBm                                                | -110dBm        | 131.8dB                     | -61.8dBm /<br>-64.8dBm                               | -66~-67dBm /<br>-69~-70dBm                                              | -67~-69dBm /<br>-69~-71dBm                                              |



### 3.0 Test Results

Testing some combination of the following parameters :

Distance Parameter Setting is 16Km

IxChariot test pair numbers

Frequency Channel

Channel Width

RF Model (High Power / Normal Power)

All Test Base on IxChariot High Performance.scr script °

#### 3.1 Test1:

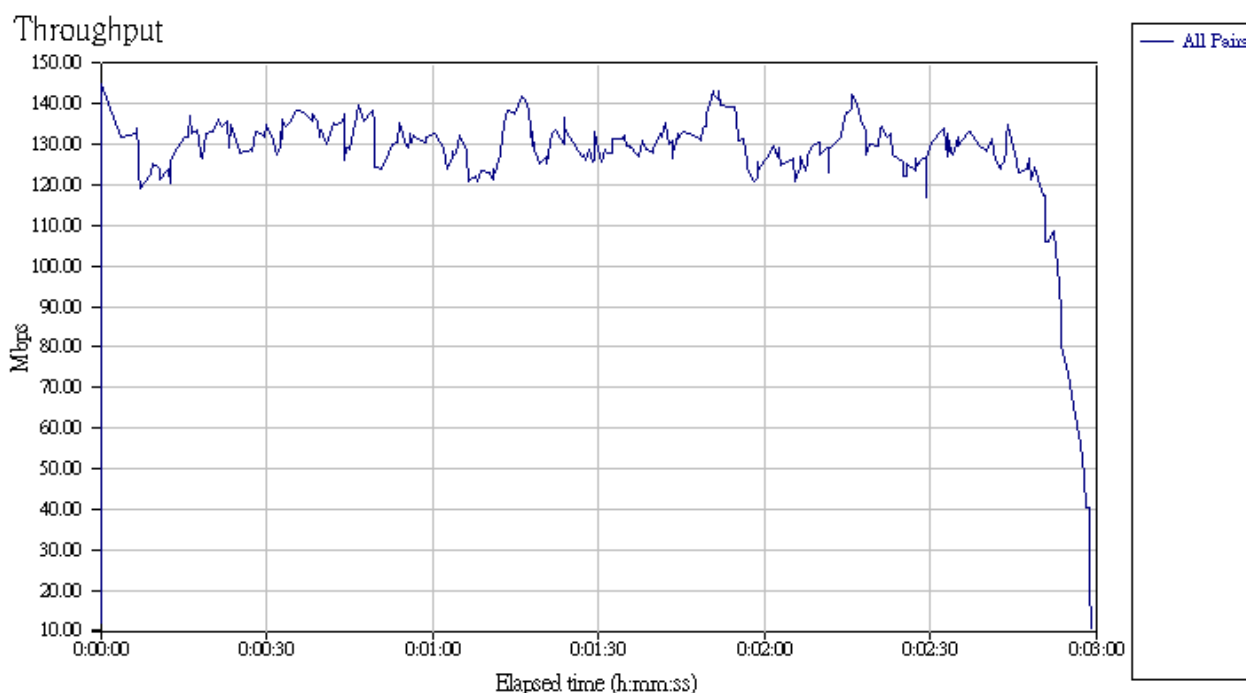
A high-power MIMO RF Module, to spread spectrum 40MHz +29dBi 5GHz dual-polarization MIMO antenna 8 received ' interval reduced from 16Km to 128Mbps Throughput

(MIMO RF Module output power maximum 21dBm general power, high-power MIMO RF Module output power maximum 24dBm)

| Frequency    | Channel Width          | RF Model      | IxChariot pairs  |
|--------------|------------------------|---------------|------------------|
| Channel - 36 | 40MHz                  | High Power    | 8T8R             |
| Report       | Total Throughput(Mbps) | Response Time | Transaction Rate |
|              | 128.006                | 9.856         | 1.641            |

#### Throughput

|         |         |       |        |
|---------|---------|-------|--------|
| Pair 16 | 7.643   | 4.435 | 15.379 |
| Totals: | 128.006 | 4.227 | 22.284 |

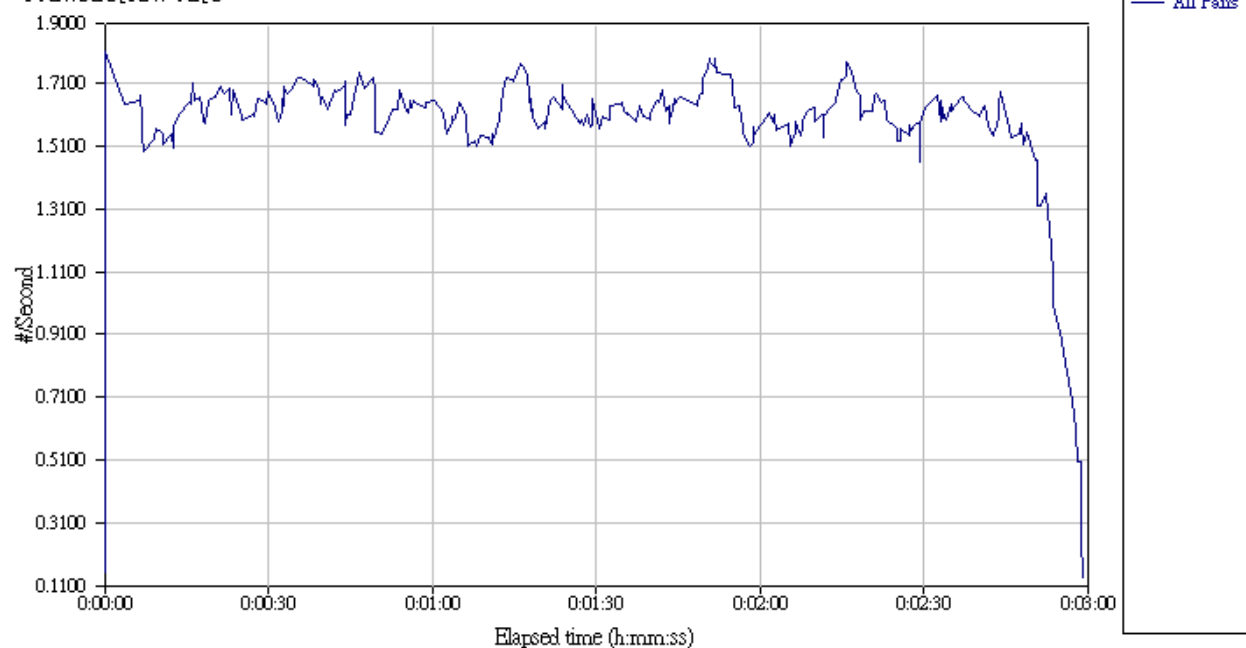




## Transaction Rate

|         |       |       |       |
|---------|-------|-------|-------|
| Pair 16 | 0.096 | 0.055 | 0.192 |
| Totals: | 1.641 | 0.053 | 0.279 |

### Transaction rate

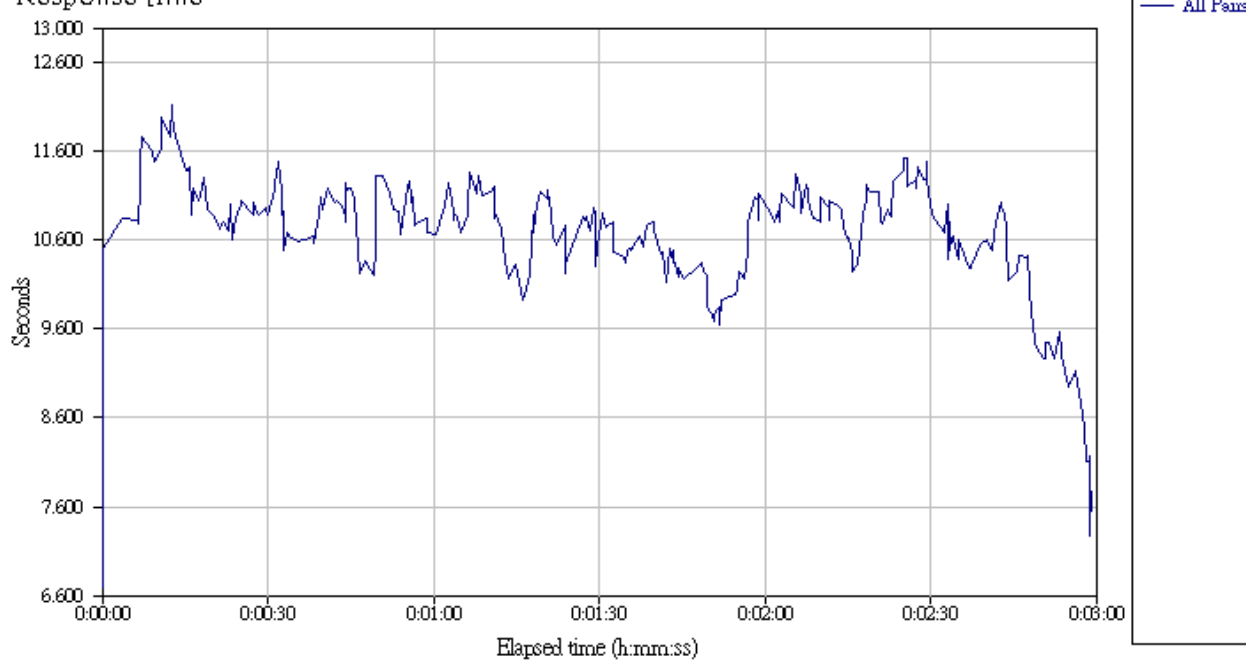


Response

## Time

|         |        |       |        |
|---------|--------|-------|--------|
| Pair 16 | 10.468 | 5.202 | 18.040 |
| Totals: | 9.856  | 3.590 | 18.924 |

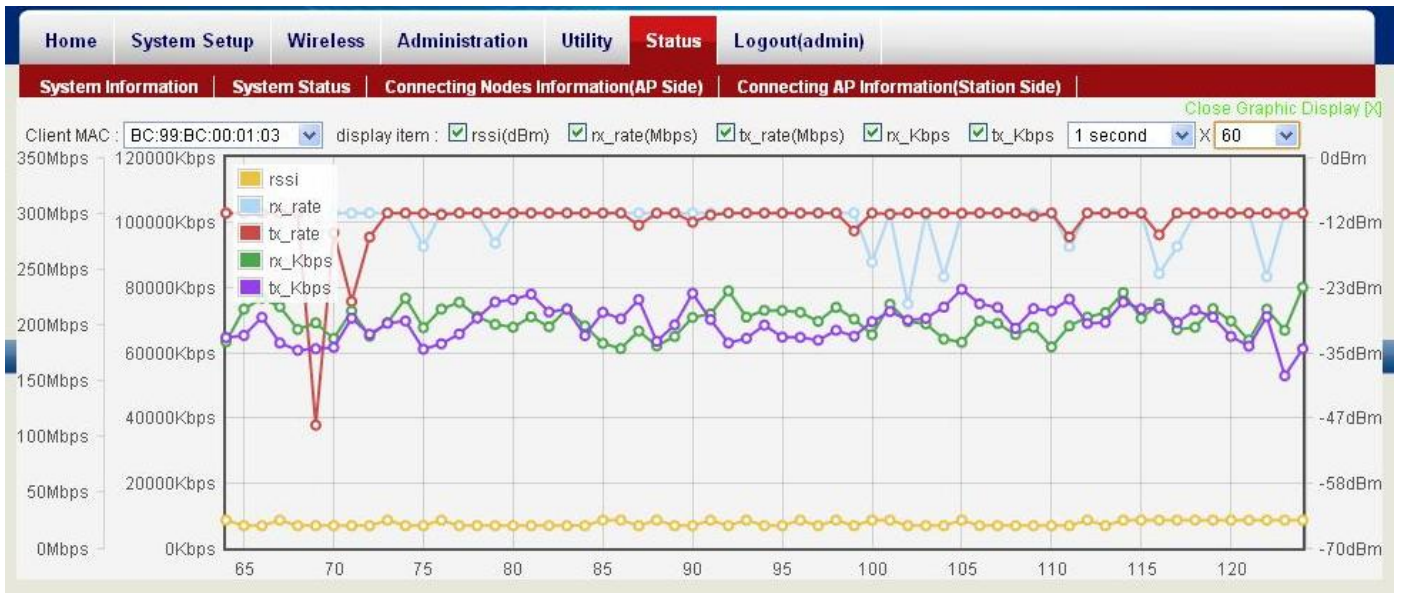
### Response time



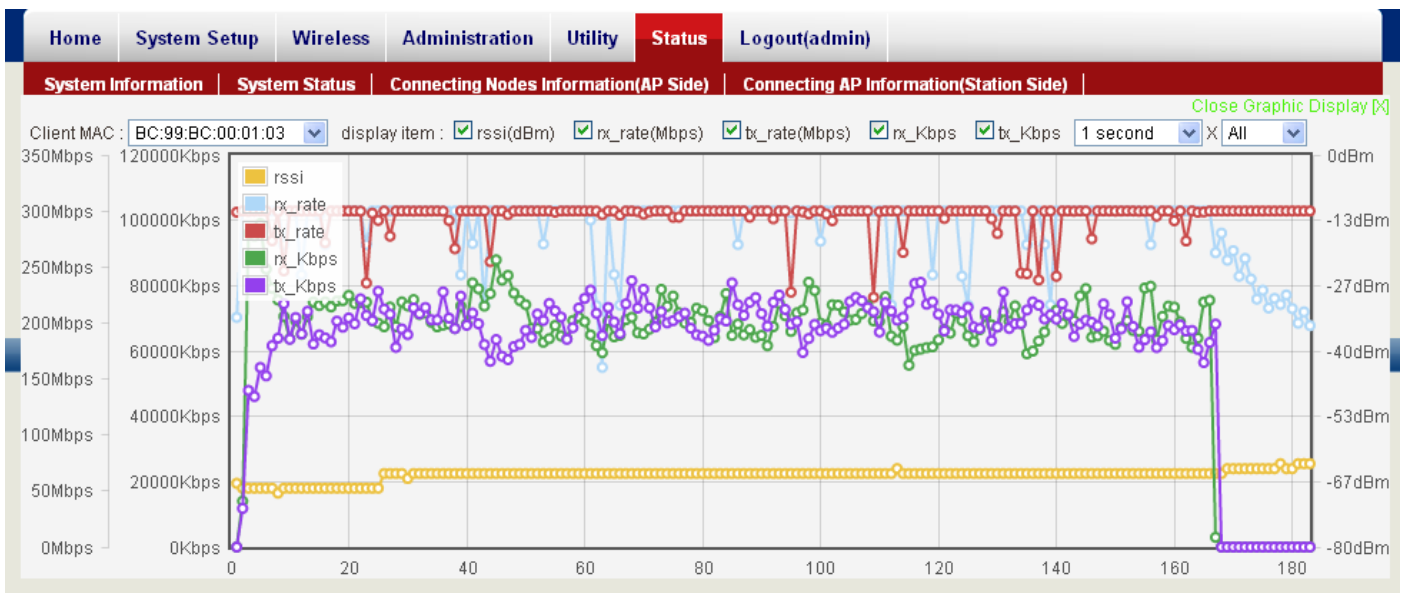




## AP Side Screen



## Station Side Screen





### 3.2 Test2:

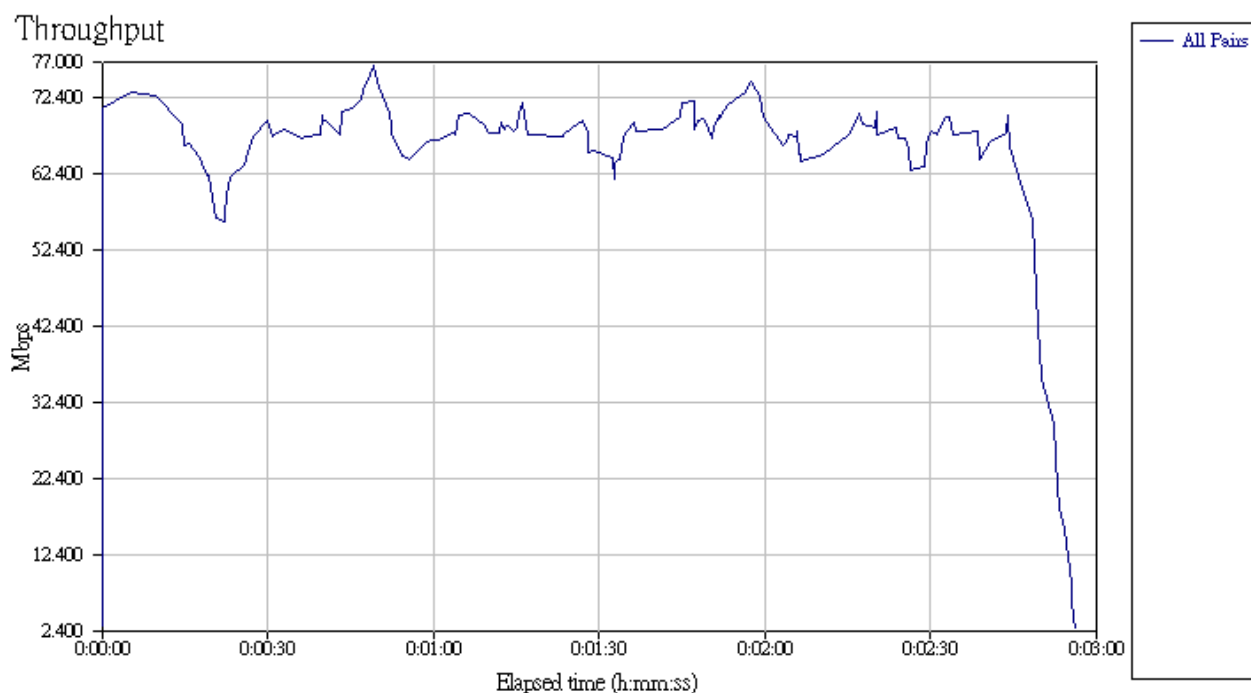
A high-power MIMO RF Module, use 20MHz Bandwidth +29dBi 5GHz dual-polarization MIMO antenna 8 received ' interval reduced from 16Km to 65.5Mbps Throughput

(MIMO RF Module output power maximum 21dBm general power, high-power MIMO RF Module output power maximum 24dBm)

| Frequency    | Channel Width          | RF Model      | IxChariot pairs  |
|--------------|------------------------|---------------|------------------|
| Channel - 36 | 20MHz                  | High Power    | 8T8R             |
| Report       | Total Throughput(Mbps) | Response Time | Transaction Rate |
|              | 65.582                 | 19.076        | 0.853            |

### Throughput

|         |        |       |        |  |
|---------|--------|-------|--------|--|
| Pair 16 | 3.893  | 2.833 | 5.326  |  |
| Totals: | 65.582 | 2.308 | 17.335 |  |

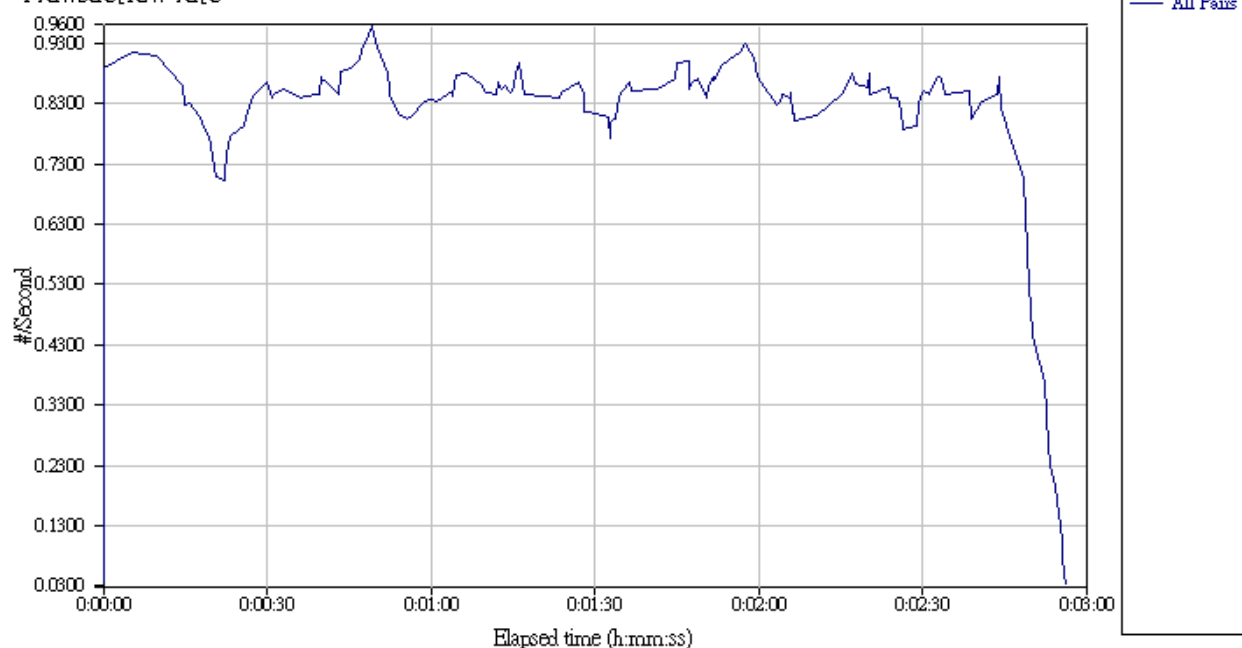




## Transaction Rate

|         |       |       |       |
|---------|-------|-------|-------|
| Pair 16 | 0.049 | 0.035 | 0.067 |
| Totals: | 0.853 | 0.029 | 0.217 |

### Transaction rate

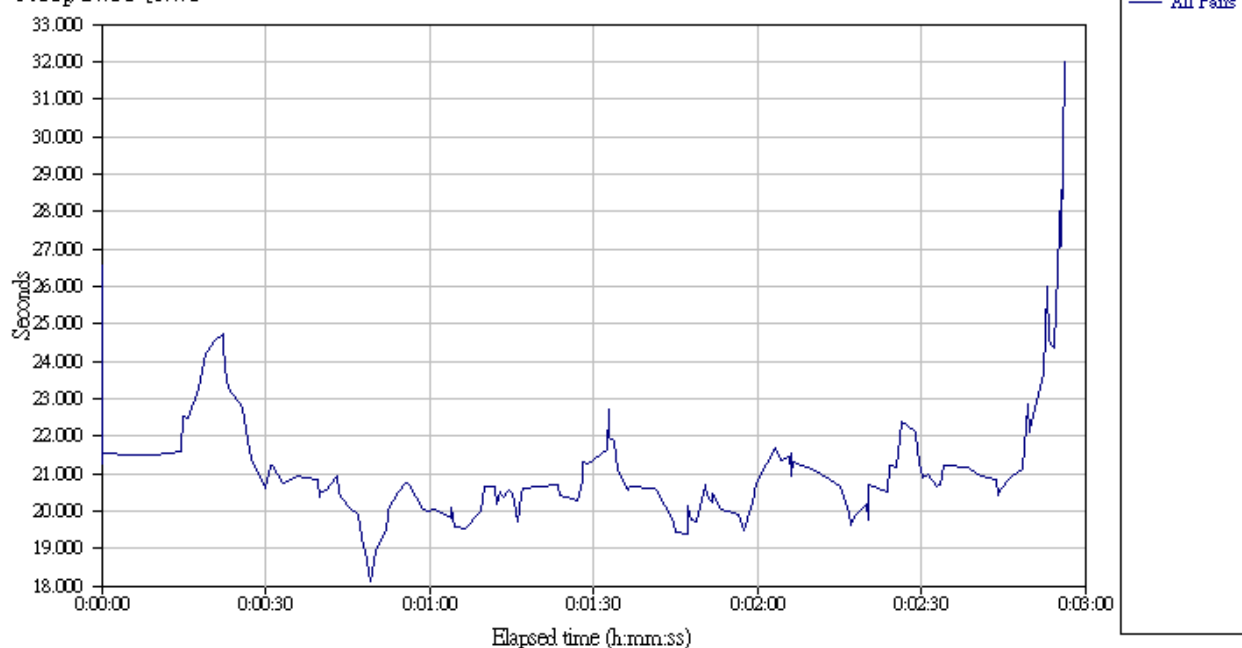


Response

## Time

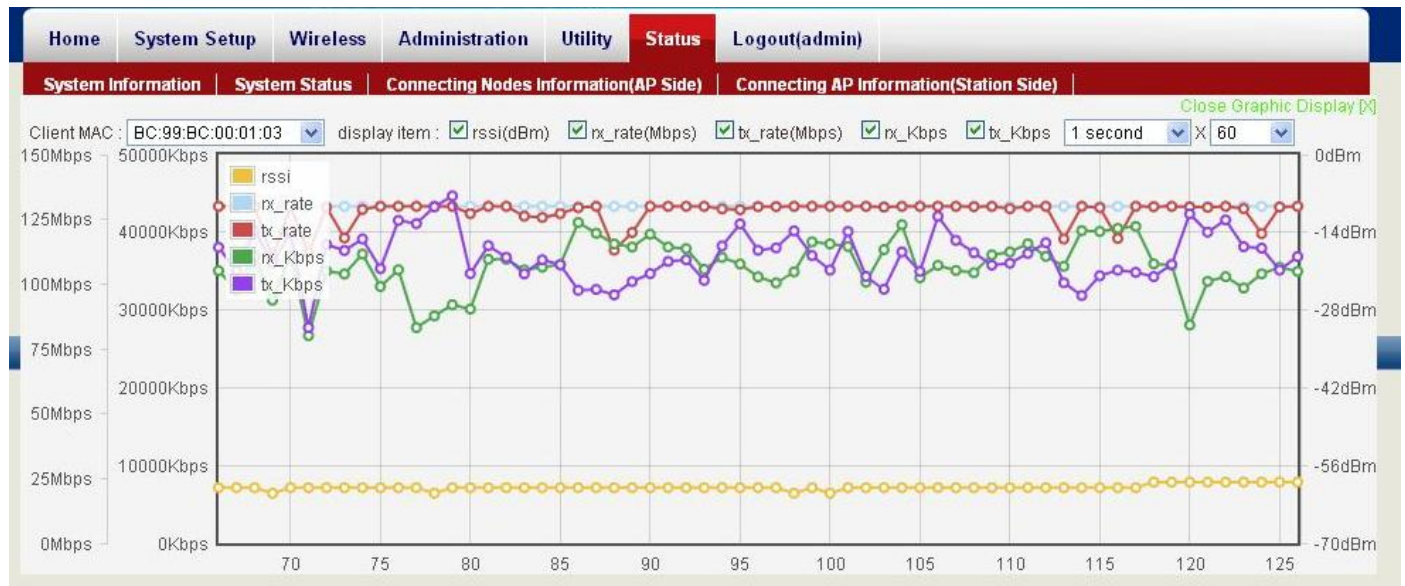
|         |        |        |        |
|---------|--------|--------|--------|
| Pair 16 | 20.548 | 15.022 | 28.241 |
| Totals: | 19.076 | 4.615  | 34.660 |

### Response time

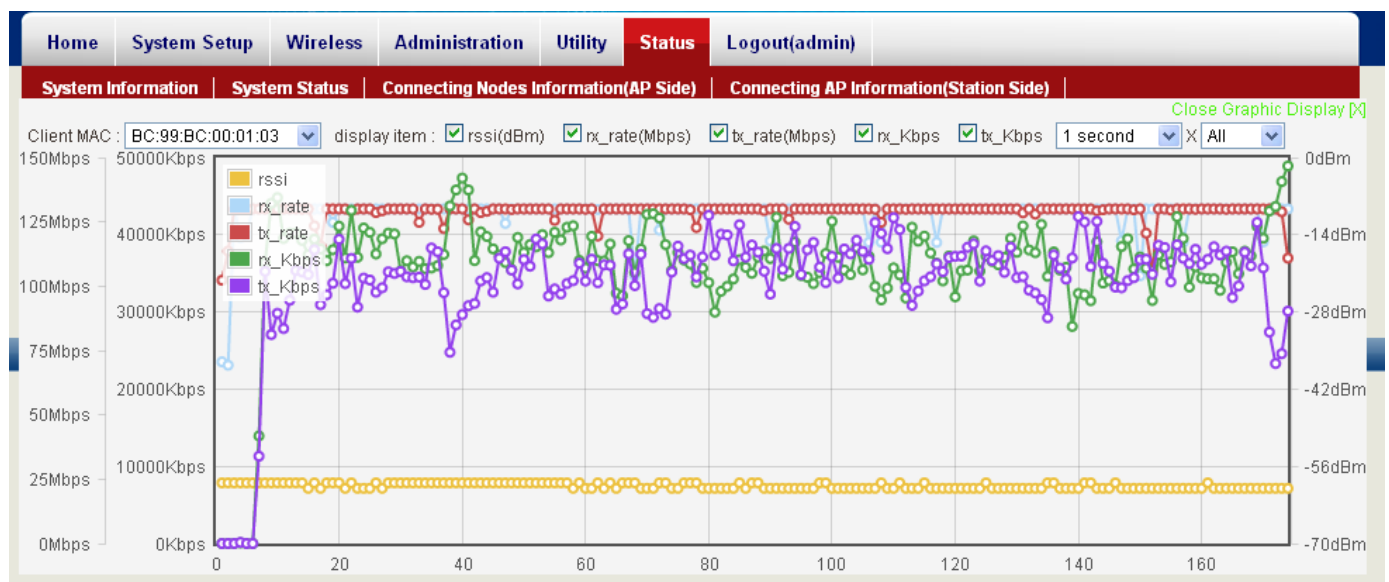




## AP Side Screen



## Station Side Screen





### 3.3 Test3 :

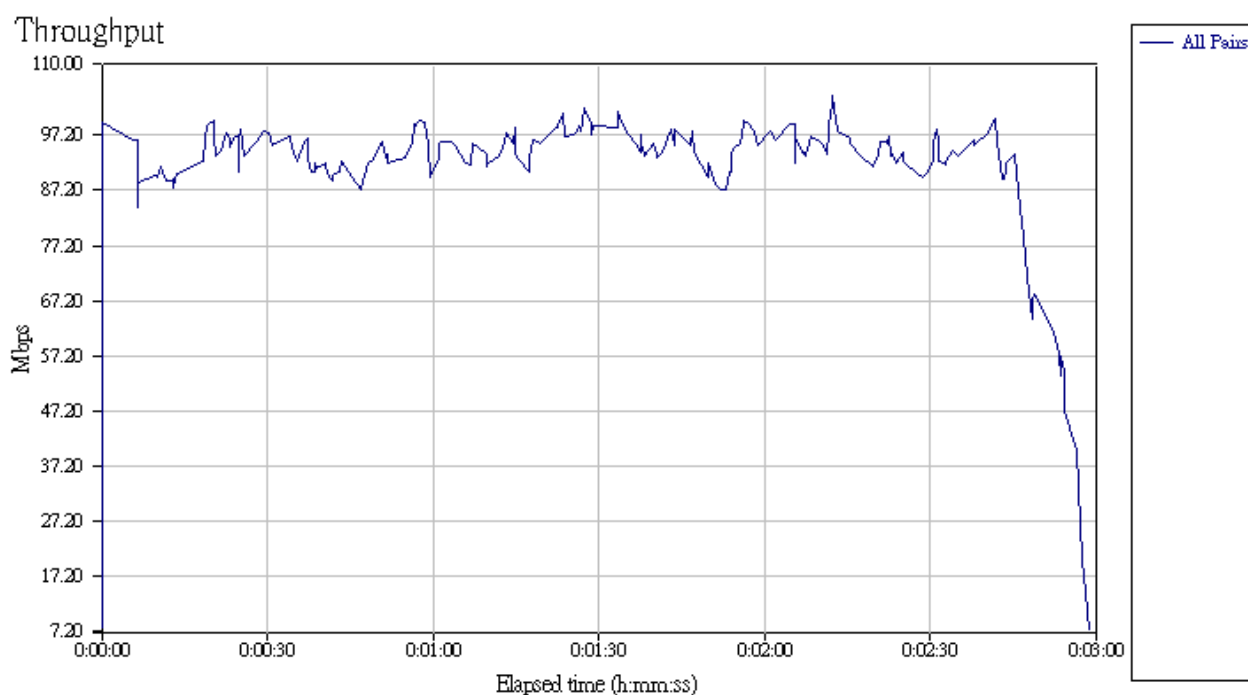
A normal-power MIMO RF Module, to spread spectrum 40MHz +29dBi 5GHz dual-polarization MIMO antenna 8 received ' interval reduced from 16Km to 91.5Mbps Throughput

(MIMO RF Module output power maximum 21dBm general power, high-power MIMO RF Module output power maximum 24dBm)

| Frequency     | Channel Width          | RF Model      | IxChariot pairs  |
|---------------|------------------------|---------------|------------------|
| Channel - 157 | 40MHz                  | Normal Power  | 8T8R             |
| Report        | Total Throughput(Mbps) | Response Time | Transaction Rate |
|               | 91.681                 | 13.634        | 1.197            |

Throughput

|         |        |       |        |
|---------|--------|-------|--------|
| Pair 16 | 6.257  | 4.511 | 10.793 |
| Totals: | 91.681 | 2.183 | 20.111 |

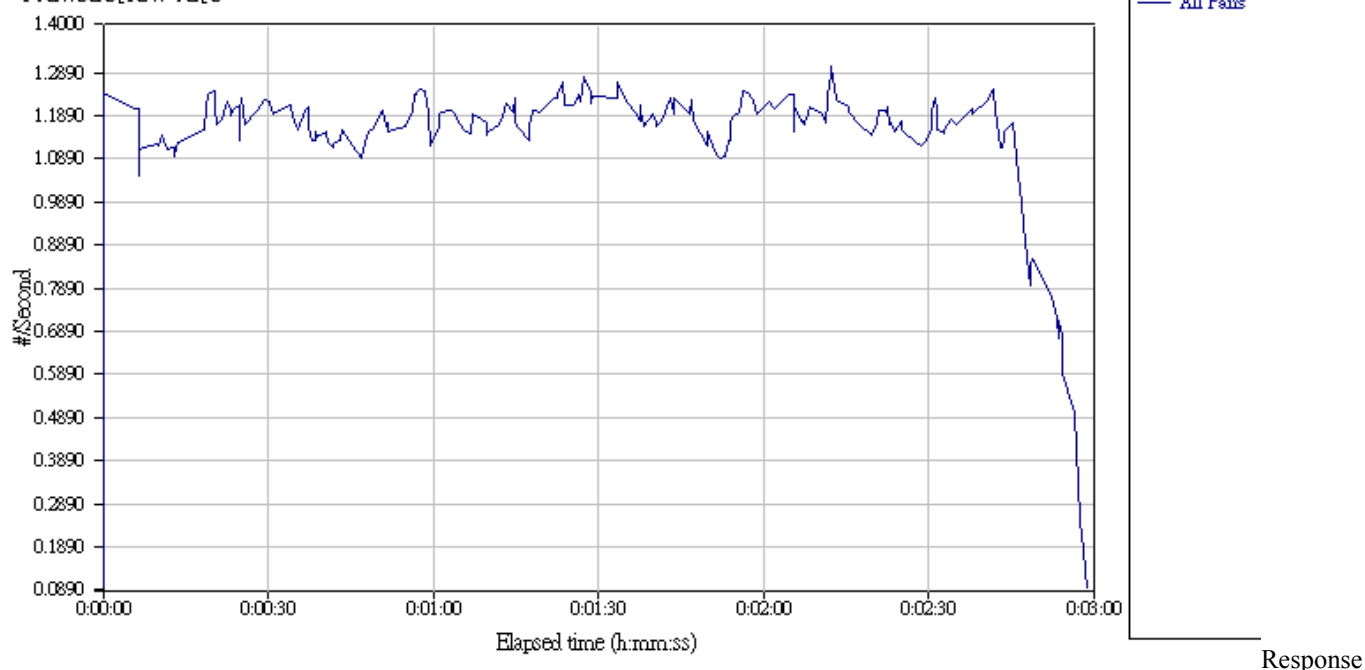




## Transaction Rate

|         |       |       |       |
|---------|-------|-------|-------|
| Pair 16 | 0.078 | 0.056 | 0.135 |
| Totals: | 1.197 | 0.027 | 0.251 |

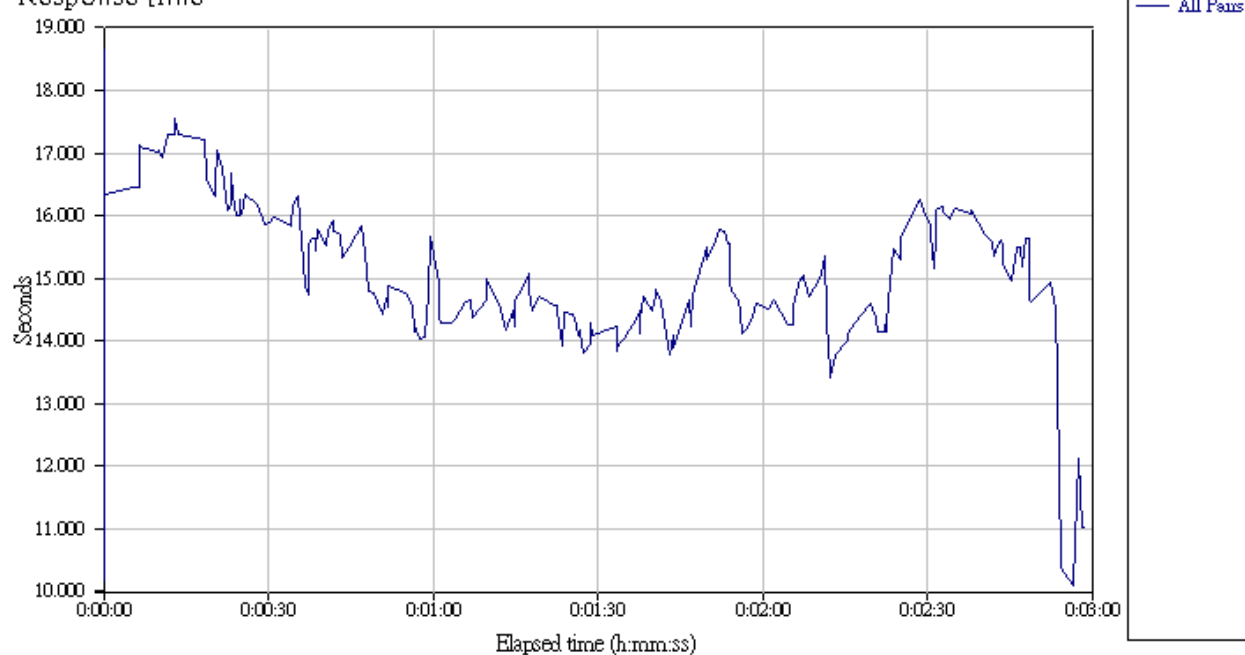
### Transaction rate



## Time

|         |        |       |        |
|---------|--------|-------|--------|
| Pair 16 | 12.787 | 7.412 | 17.734 |
| Totals: | 13.634 | 3.978 | 36.645 |

### Response time



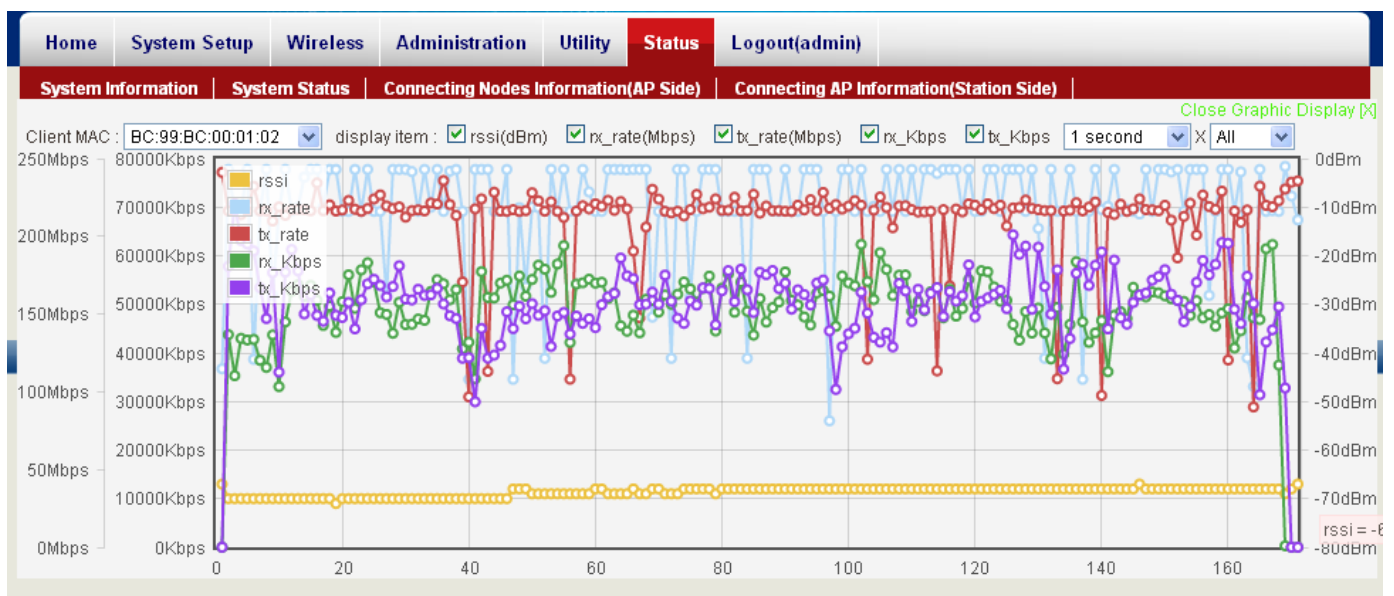




## AP Side Screen



## Station Side Screen





### 3.4 Test4

A normal-power MIMO RF Module, use 20MHz Bandwidth +29dBi 5GHz dual-polarization MIMO antenna 8 received ' interval reduced from 16Km to 63.5Mbps Throughput

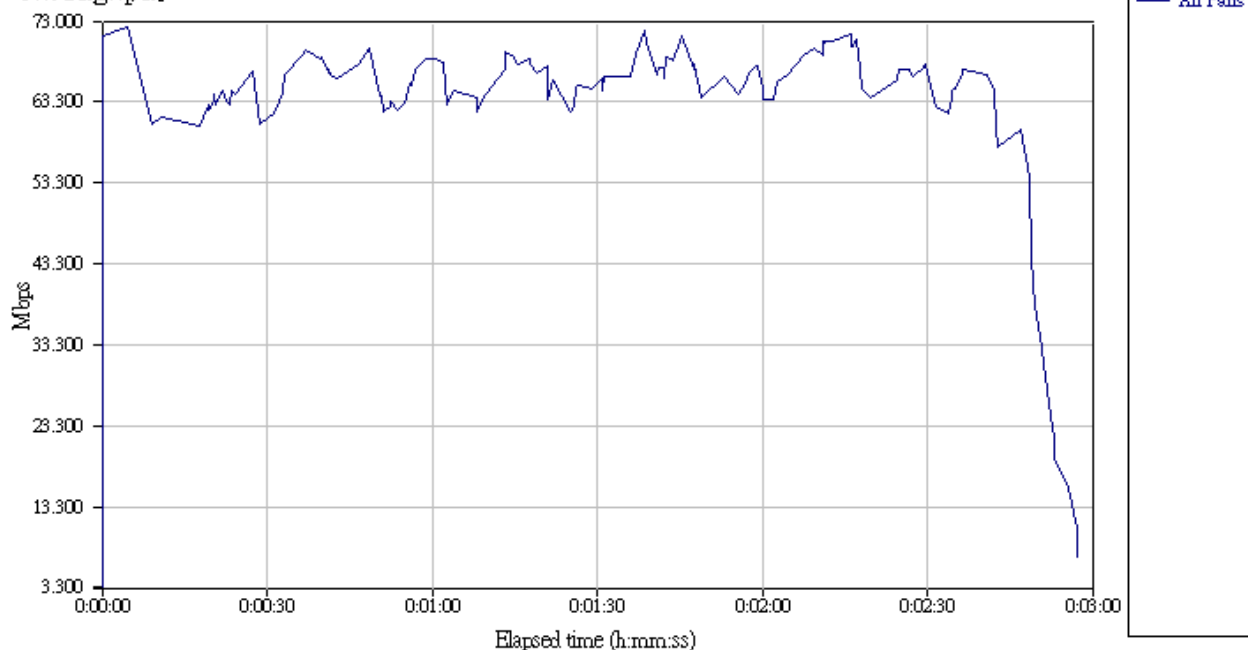
(MIMO RF Module output power maximum 21dBm general power, high-power MIMO RF Module output power maximum 24dBm)

| Frequency     | Channel Width          | RF Model      | IxChariot pairs  |
|---------------|------------------------|---------------|------------------|
| Channel - 100 | 20MHz                  | Normal Power  | 8T8R             |
| Report        | Total Throughput(Mbps) | Response Time | Transaction Rate |
|               | 63.567                 | 19.990        | 0.835            |

### Throughput

|         |        |       |        |
|---------|--------|-------|--------|
| Pair 16 | 3.313  | 2.414 | 4.612  |
| Totals: | 63.567 | 2.328 | 17.929 |

### Throughput



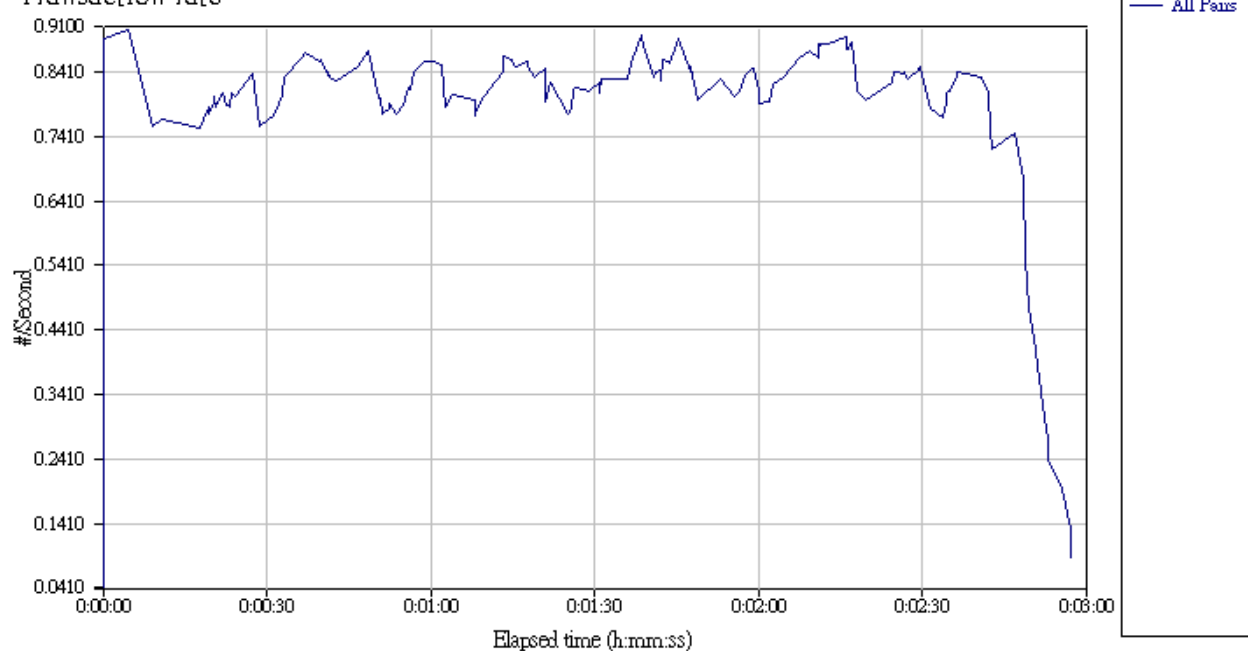




## Transaction Rate

|         |       |       |       |
|---------|-------|-------|-------|
| Pair 16 | 0.041 | 0.030 | 0.058 |
| Totals: | 0.835 | 0.029 | 0.224 |

### Transaction rate

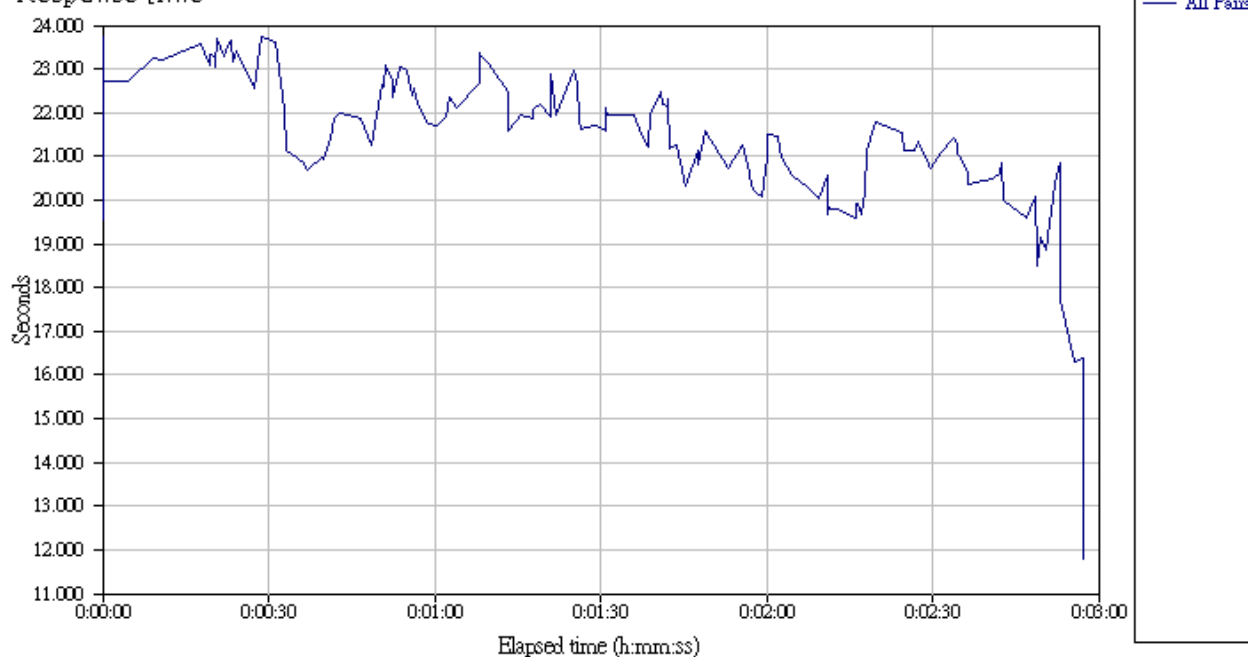


Response

## Time

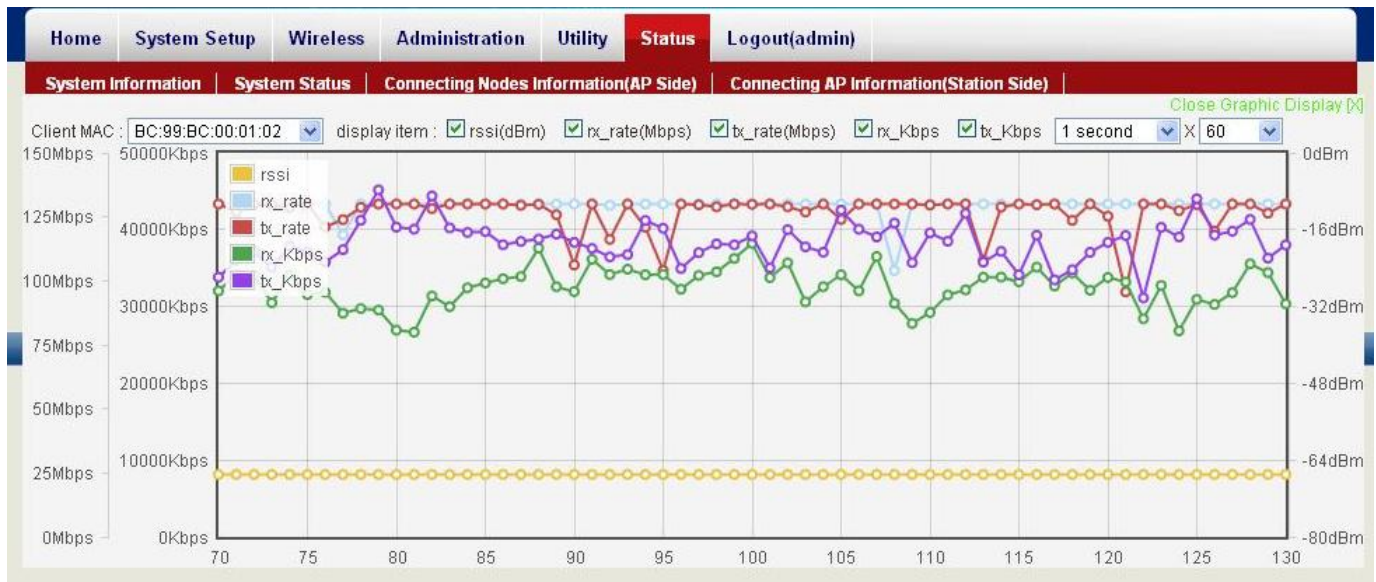
|         |        |        |        |
|---------|--------|--------|--------|
| Pair 16 | 24.147 | 17.345 | 33.140 |
| Totals: | 19.990 | 4.462  | 34.370 |

### Response time

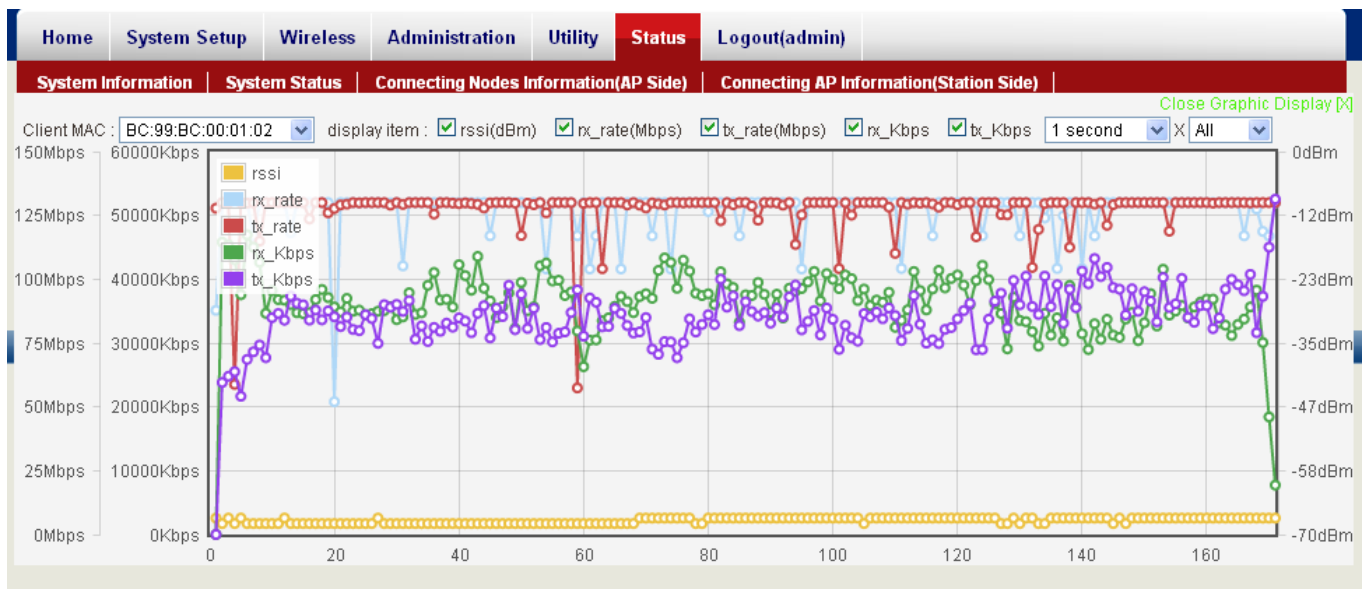




## AP Side Screen



## Station Side Screen



## Appendix I

Non °