



---

Fixed network operations of  
Hutchison Whampoa Limited



## **BROADBAND WIRELESS ACCESS**

### **TRIAL REPORT**

**OCTOBER 2005**

<b>TABLE OF CONTENTS .....</b>	<b>PAGE</b>
<b>1. EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>2. OBJECTIVE.....</b>	<b>3</b>
<b>3. NATURE AND SCALE .....</b>	<b>3</b>
<b>4. TECHNICAL INFORMATION.....</b>	<b>3</b>
<b>4.1 FREQUENCY BAND AND BANDWIDTH.....</b>	<b>3</b>
<b>4.2 AIR INTERFACE &amp; DUPLEXING.....</b>	<b>3</b>
<b>5. POINT TO POINT TESTS .....</b>	<b>4</b>
<b>5.1 TEST CONFIGURATIONS .....</b>	<b>4</b>
<b>5.2 NETWORK DIAGRAMS FOR POINT-TO-POINT TESTS .....</b>	<b>6</b>
<b>5.2.1 Network Diagram for Point-to-Point Tests based on E1 Signal .....</b>	<b>6</b>
<b>5.2.2 Network Diagram for Point-to-Point Tests based on 100 BaseT Signal .....</b>	<b>6</b>
<b>6. POINT TO MULTIPOINT TESTS.....</b>	<b>7</b>
<b>6.1 TEST CONFIGURATION .....</b>	<b>7</b>
<b>6.2 NETWORK DIAGRAMS .....</b>	<b>8</b>
<b>6.2.1 Network Diagram for Point-to-Multipoint Tests based on E1 Signal.....</b>	<b>8</b>
<b>6.2.2 Network Diagram for Point-to-Multipoint Tests based on 100BaseT Signal.....</b>	<b>8</b>
<b>7. TEST RESULTS .....</b>	<b>9</b>
<b>7.1 SUMMARY OF TEST RESULTS .....</b>	<b>9</b>
<b>7.2 NOTES ON TEST RESULTS.....</b>	<b>9</b>

## **1. Executive Summary**

A wireless Broadband system based on pre-WiMAX standard was used to set up point to point and point to multipoint links and tested to evaluate its throughput and delay performance under line of sight (LOS) and non line of sight (NLOS) conditions.

Under LOS conditions, both point to point and point to multipoint links performed well. Trial tests under NLOS conditions are less predictable and not conclusive; more extensive tests would be required for fully verifying NLOS performance of the system.

## **2. Objective**

To test the outdoor LOS and NLOS performance of the system under test based on E1 and 100 Base-T Ethernet Signal.

## **3. Nature and scale**

This report documents the results of the trials, which had been conducted in the outdoor environment during the month of July 2005.

The system under test is a commercially available product from a leading wireless broadband equipment vendor. The trial used ANT-20 to verify E1 services and SmartBits 600 to test the 100 Base-T Ethernet throughput.

Both line of sight (LOS) and non-line of sight (NLOS) tests had been conducted. In addition, point-to-multipoint tests under LOS condition were also conducted.

## **4. Technical information**

### **4.1 Frequency band and bandwidth**

The base station and subscriber stations can be configured from 3.4 to 3.8 GHz (licensed band) with centre frequency tuneable and channel change in steps of 250kHz.

Frequency Band Tested Channel: 3.424 GHz (centre frequency)

Channel Size of frequency band = 14MHz (unpaired)

### **4.2 Air Interface & Duplexing**

The air interface of the radio equipment is based on 802.16a standard using TDD (Time Division Duplexing).

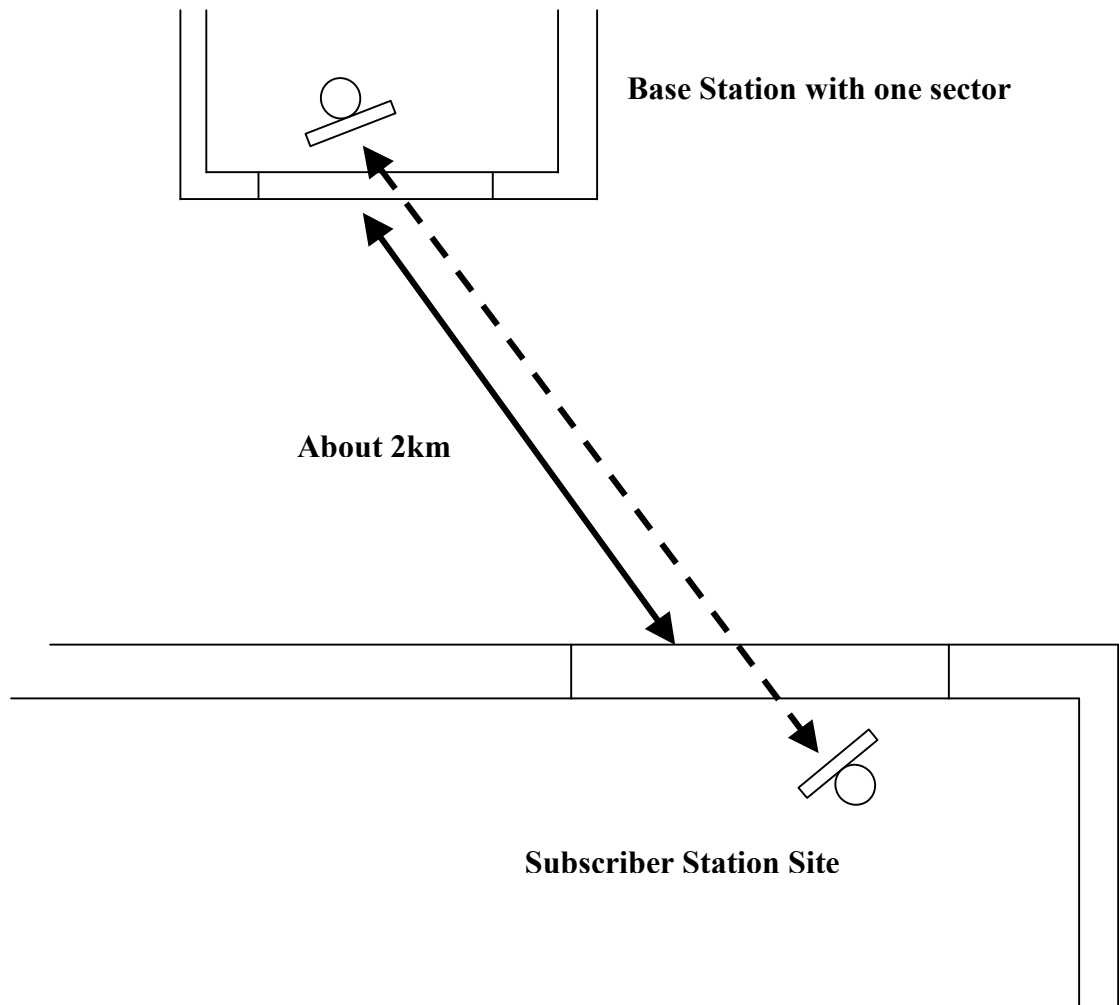
## 5. Point to Point Tests

### 5.1 Test Configurations

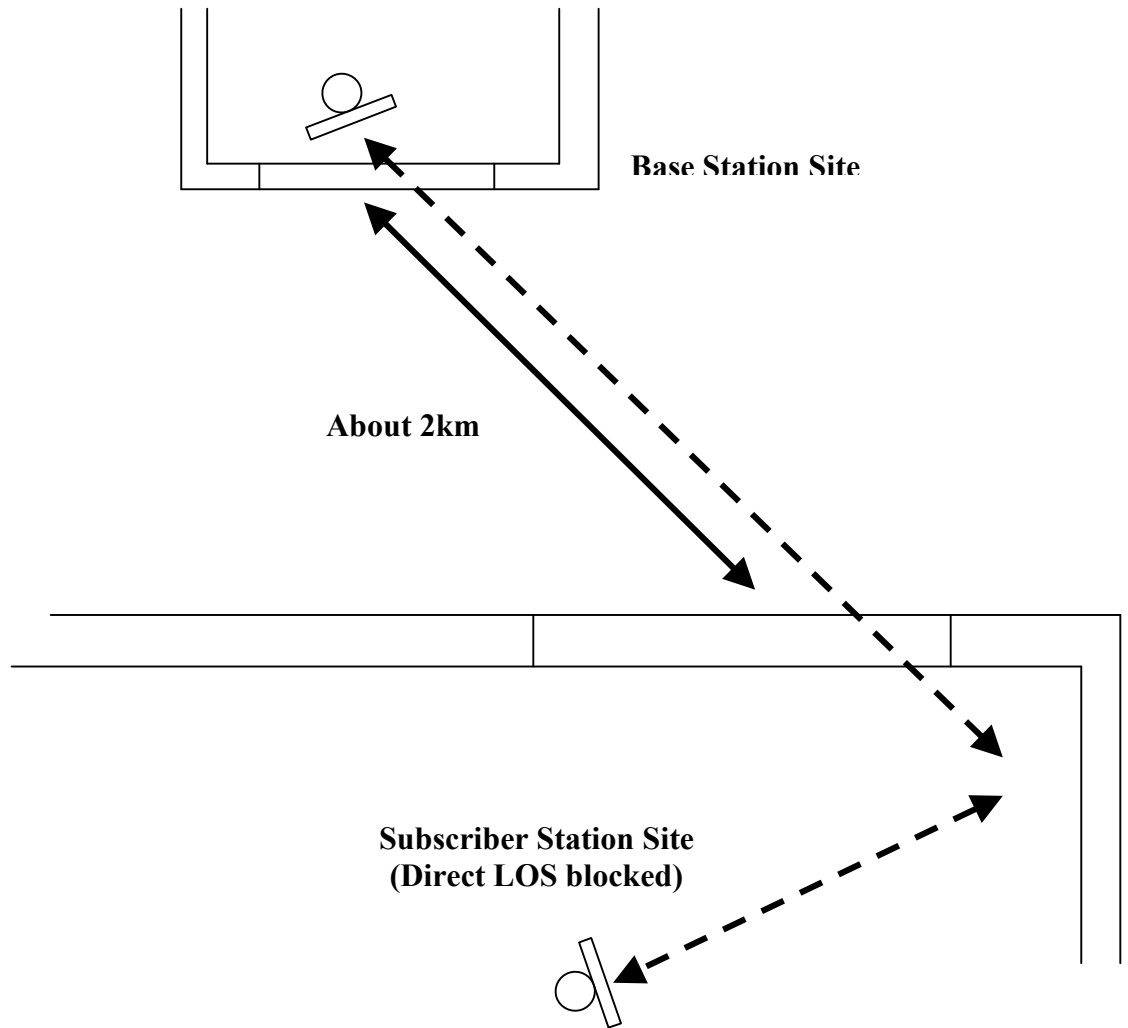
The field trials had been conducted in the area around Tsing Yi.

One base station with one sector was installed. A subscriber station within line of sight coverage of the base station was used to set up a point-to-point link.

### Configuration for LOS Tests

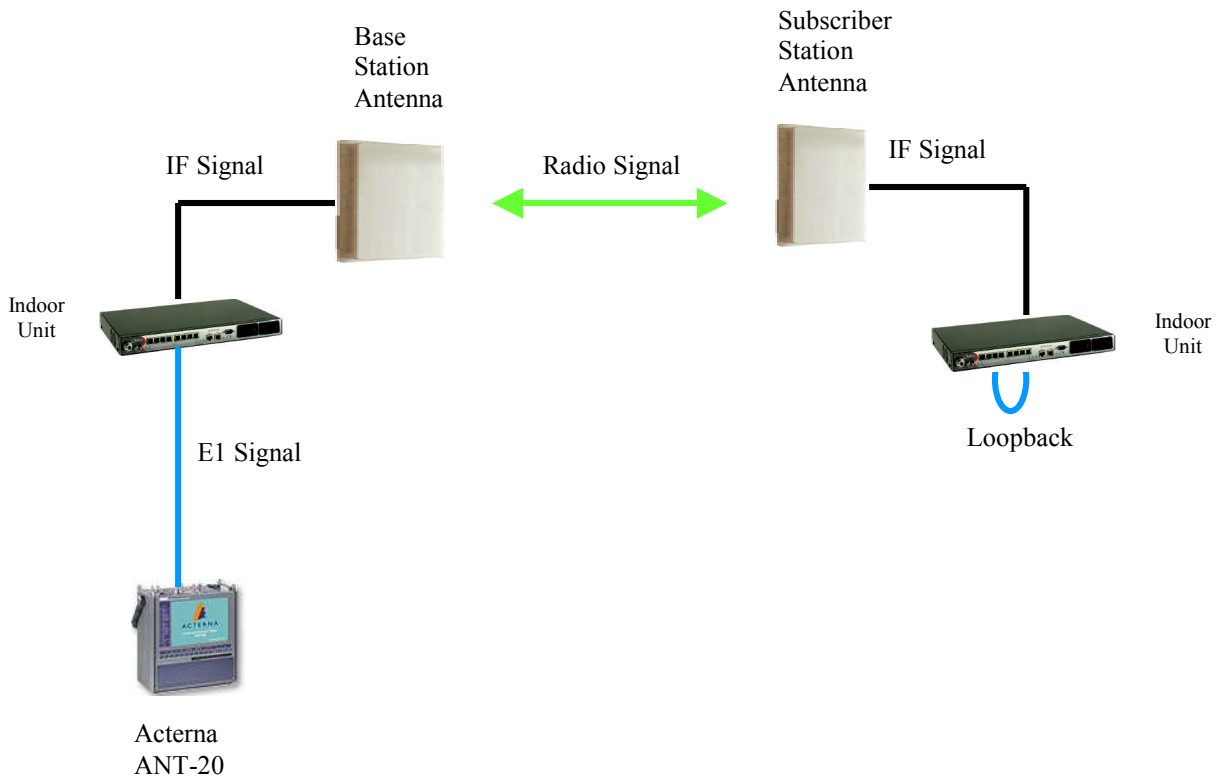


## Configuration for NLOS Tests (Single Reflection)

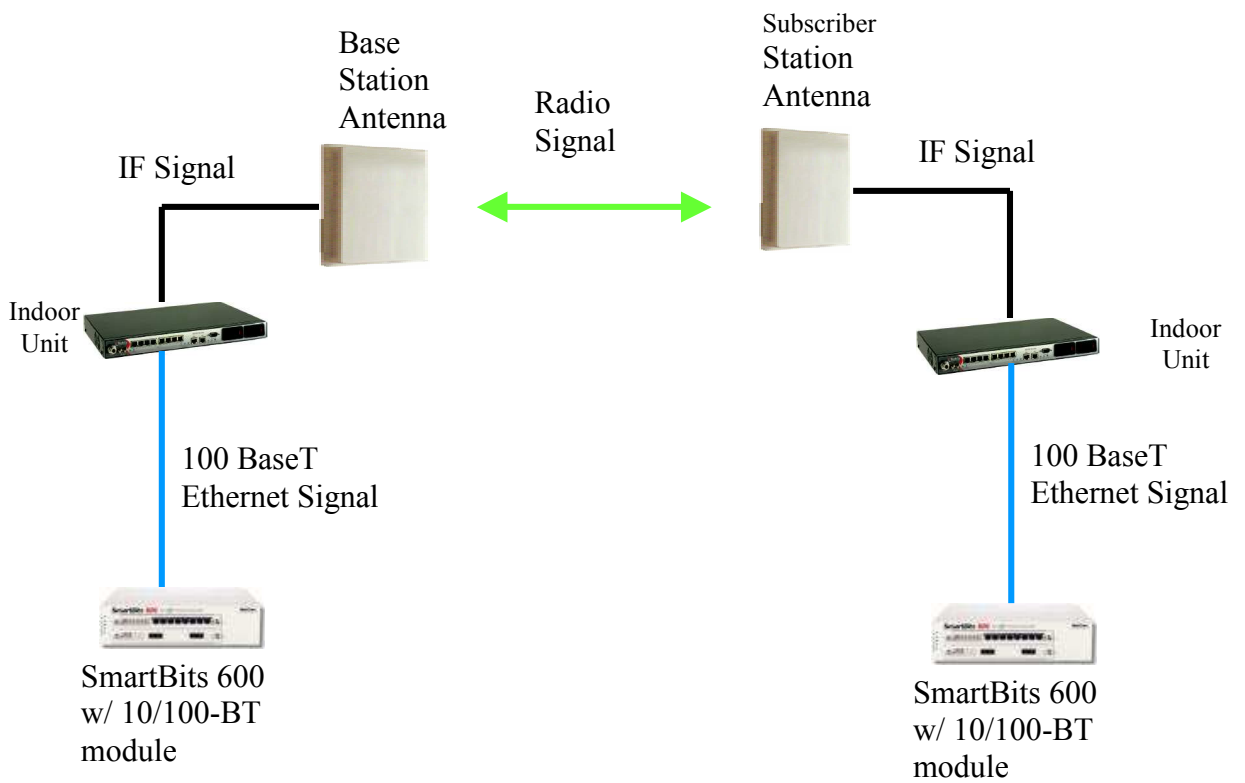


## 5.2 Network Diagrams for Point-to-Point Tests

### 5.2.1 Network Diagram for Point-to-Point Tests based on E1 Signal



### 5.2.2 Network Diagram for Point-to-Point Tests based on 100 BaseT Signal

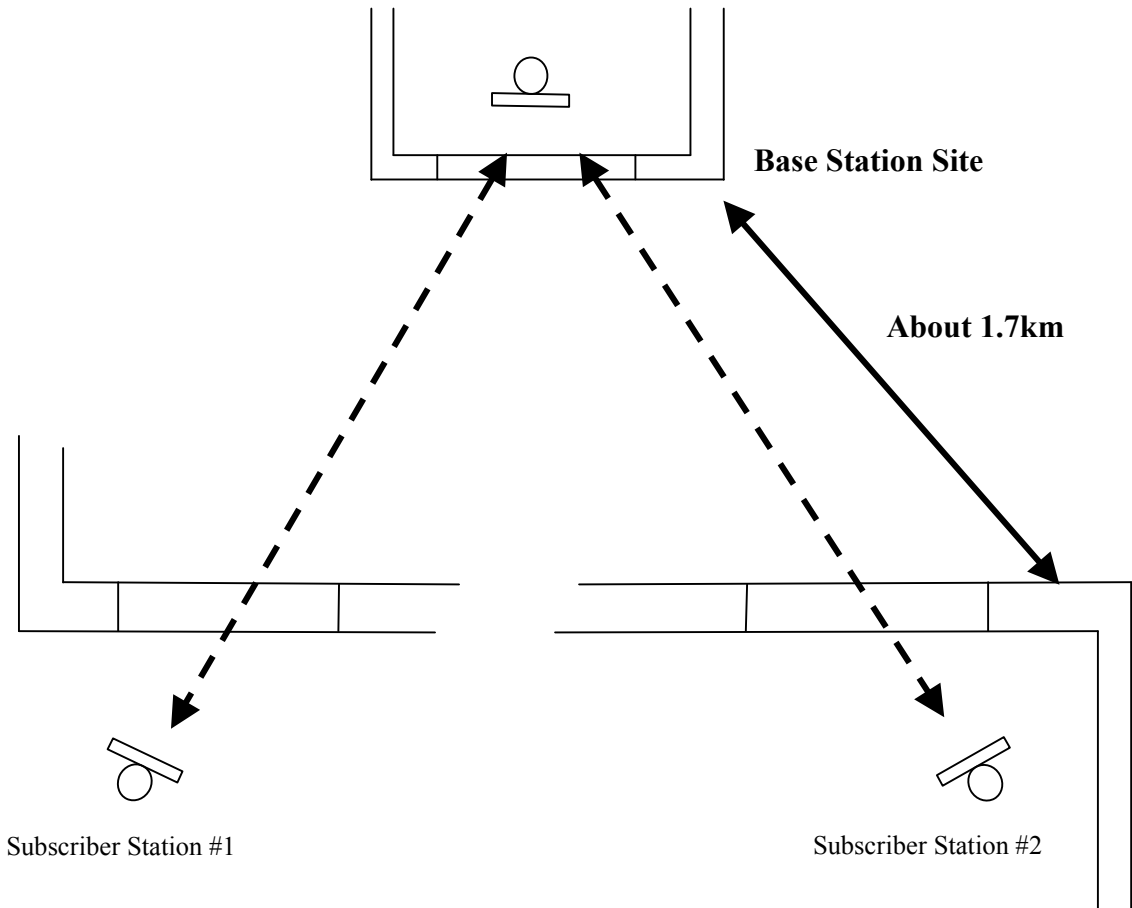


## 6. Point to Multipoint Tests

### 6.1 Test Configuration

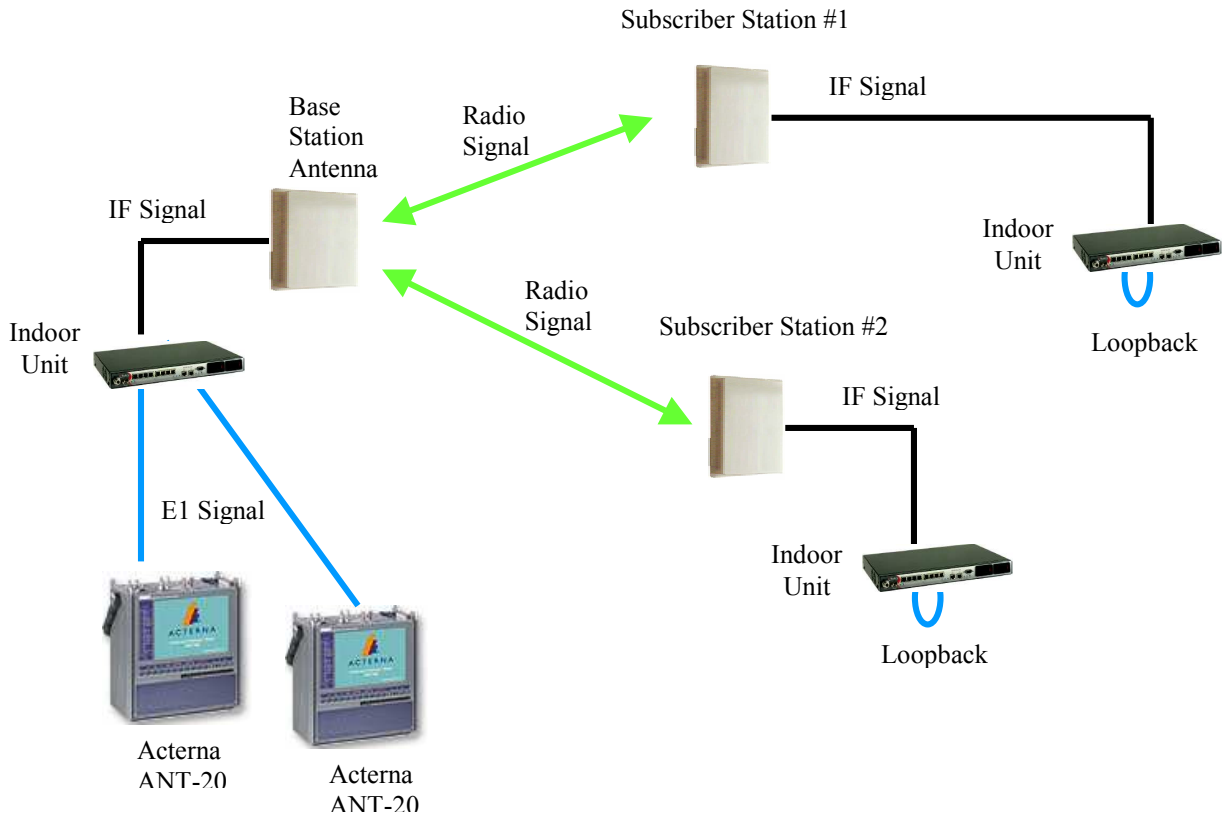
The field trials had been conducted in the area around Tsing Yi. One base station with one sector was installed to simultaneously serve two subscriber stations.

#### Point to Multipoint Test Configuration

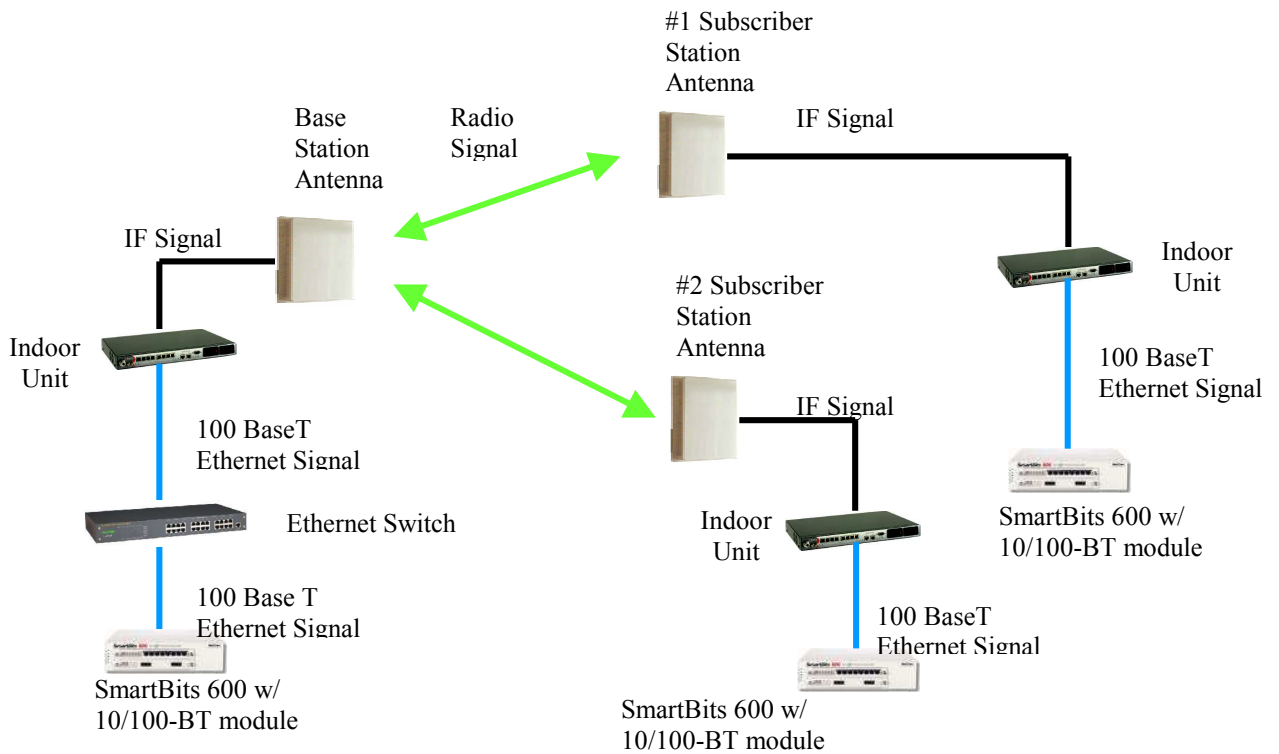


## 6.2 Network Diagrams

### 6.2.1 Network Diagram for Point-to-Multipoint Tests based on E1 Signal



### 6.2.2 Network Diagram for Point-to-Multipoint Tests based on 100BaseT Signal



## 7. Test Results

### 7.1 Summary of Test Results

	Test Configuration	Test Result	Remark
<b>1.</b>	<b>Outdoor point-to-point LOS Tests</b>		
1.1	E1 BER test	No bit error	Provided LOS is clear
1.2	E1 Round-trip delay	25ms	
1.3	100 BaseT Throughput	17M full duplex	
<b>2.</b>	<b>Outdoor point-to-point NLOS Tests (single reflection only)</b>		
2.1	E1 BER test	No bit error	Provided whole path is clear of obstruction
2.2	E1 Round-trip delay	31ms	
2.3	100 BaseT Throughput	17M full duplex	
<b>3.</b>	<b>Outdoor point-to-multipoint LOS Tests</b>		
3.1	E1 BER test (Subscriber Stn #1)	No bit error	Provided LOS is clear
3.2	E1 BER test (Subscriber Stn #2)	No bit error	Provided LOS is clear
3.3	E1 Round-trip delay (Subscriber Stn #1)	34.12 ms	
3.4	E1 Round-trip delay (Subscriber Stn #2)	31.06ms	
3.5	100 BaseT Throughput (Subscriber Stn #1)	8M full duplex (No packet loss)	
3.6	100 BaseT Throughput (Subscriber Stn #2)	8M full duplex (No packet loss)	
3.7	100 BaseT Throughput (Subscriber Stn #1)	9M full duplex (10% packet loss)	
3.8	100 BaseT Throughput (Subscriber Stn #2)	9M full duplex (10% packet loss)	

### 7.2 Notes on Test Results

The system under test appeared to perform very well under LOS conditions.

The maximum throughput of the system based on 14MHz spectrum is about 34Mb/s or 17Mb/s full duplex showing a reasonably good spectral efficiency and this throughput can basically be maintained when working in a point to multipoint configuration.

The performance under NLOS conditions is less conclusive. While propagation after one single reflection can be shown to work well, performance under situations of multiple reflections is less predictable.

More extensive testing involving more facilities (trial sites, test equipment, base station, subscriber station, etc) will need to be conducted in order to verify how well the system can perform under NLOS conditions.