

RCP Series Training kit



Zcomax Technologies, Inc.

Agenda

- **Why choose the Zcomax RCP?**
- **The core technology**
- **Operation modes**
- **Hardware installation**
- **Software configuration**

Why Choose The Zcomax RCP?

- **Professionally designed long distance outdoor wireless device**
 - **Achieves wireless back-haul distances greater than 100Km**
 - **Resolves long distance problems common with many standard WiFi devices**
 - **Affordable and reliable rural connectivity design**
 - **An ideal WISP solution to serve as a last mile broadband connectivity products**

Product Series Overview

Product Series	Product Name	Description		
		Radio Card	Typical Application	Antenna
Value Series	R1 Extender (ZC-3625-5-23)	XA-623AH (5GHz)	Point-to-Point bridging	Standard 23dBi Directional antenna,
Power Series	R2 Extender (ZC-3625-55-23)	XA-623AH (5GHz) XA-623AH (5GHz)	1) Point-to-Point 2) Point-to-Multipoint bridging with option external directional antenna added 3) 5GHz radio card Point-to-Point Bridging. other 5GHz(R2E) or 2.4 GHz(R2BS) radio card for local wireless coverage with external omni-directional antenna	Standard 23dBi Directional antenna, extra antennas for R2 series
	R2 BS BaseStation (ZC-3625-52-23)	XA-623AH (5GHz) XG-623GH (2.4GHz)		

Why Choose The Zcomax RCP?

- **RCP Highlights**

- Long distance connectivity
- Broad bandwidth and high throughput
- High reliability
 - *Enclosed design for IP67 standard*
- Strong security
 - *Support for WEP 64/128, WPA-PSK/WPA2-PSK, WPA/WPA2*

Core technology

- **TDMA**
 - CSMA brief
 - Introduction
 - TDM Coordination
 - CSMA vs. TDMA

- **Link Aggregation**
 - Overview
 - Advantages

What is CSMA (1/3)

- Carrier Sense Multiple Access
- Detects if wireless medium is being used or not before attempting to transmit.
 - *If busy, the sender waits to transmit*
 - *If clear, then transmission takes place*
 - *If a collision occurs, the host will send a short jamming signal causing the sender to wait until clear*

What is CSMA (2/3)

- **Simply:**

Before speaking everyone listens first...

If nobody else is speaking...then it's clear to speak!



Listening then
speaking method can
easily cause collisions
in long distance links

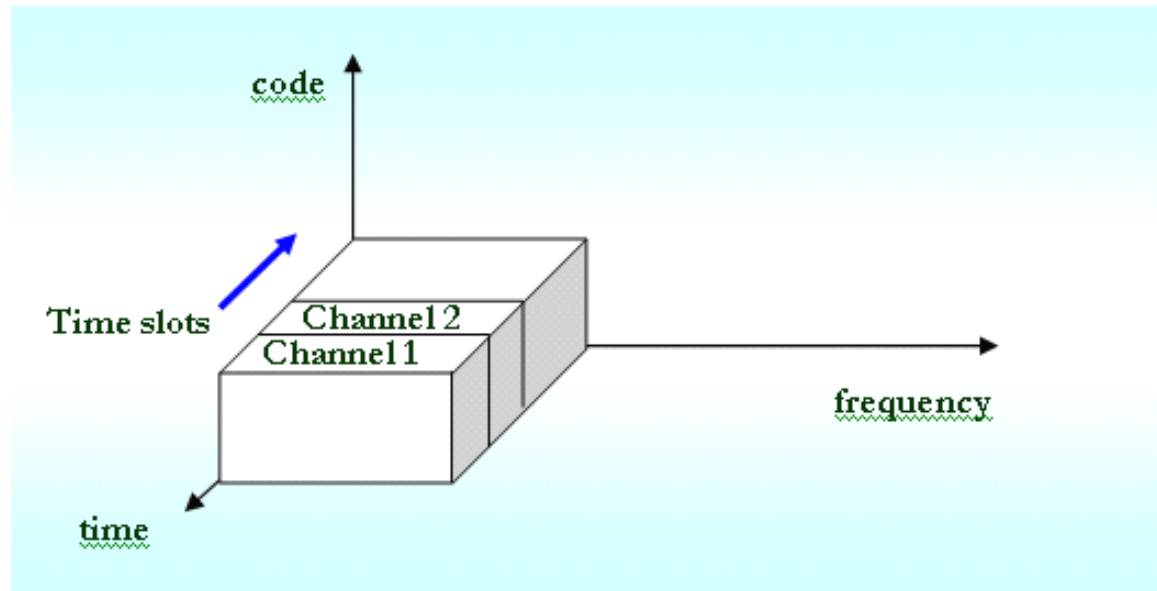
What is CSMA (3/3)

- **What's the problem with CSMA**
 - **Unidirectional transfer so data is easily lost**
 - **As distance increases, the effect of collision-detecting becomes worse**
 - **For long distance scenarios, the transmission delay seriously effects performance**

What is TDMA (1/3)

- Time Division Multiple Access

- A technology for dividing a radio frequency into time slots and then allocating slots to multiple users



What is TDMA (2/3)

- **Simply:**
 - Think of it as giving each person in a room a 10 second period to talk
 - A person is only allowed to talk during their 10 second allocated time period



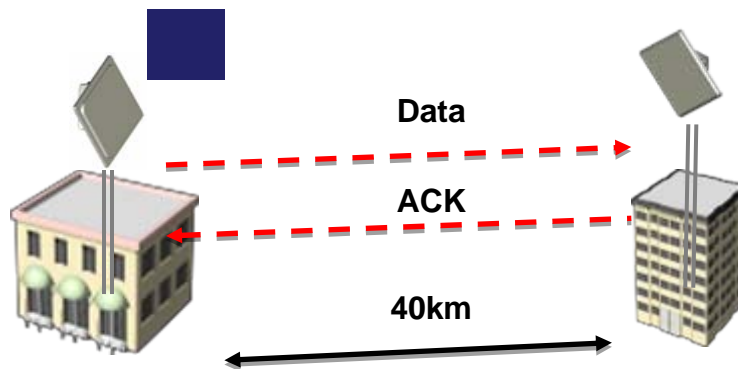
**Only one person
can speak during
their allocated
time**

What is TDMA (3/3)

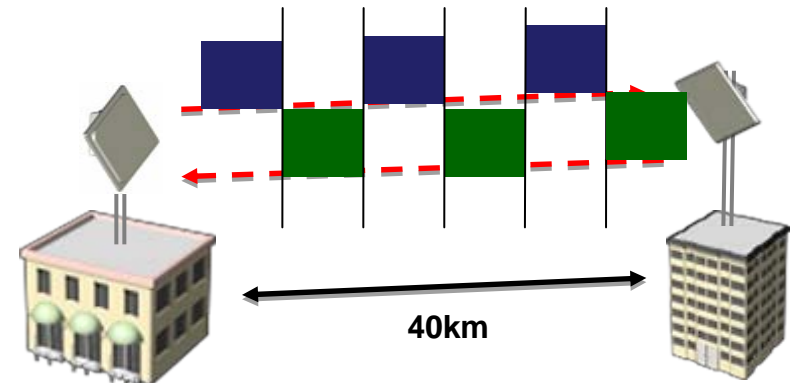
- **The advantages of the RCP TDMA**
 - **Solves “hidden node” collision problems**
 - **No ACK necessary**
 - **Consistent bandwidth**
 - **Cost-effective connectivity solution**
 - **Specifically designed for long-distance transmission links**

CSMA vs. TDMA (1/2)

	802.11 CSMA	RCP TDMA
Collision	worse	better
Bandwidth	narrower	wider
Range	short	long



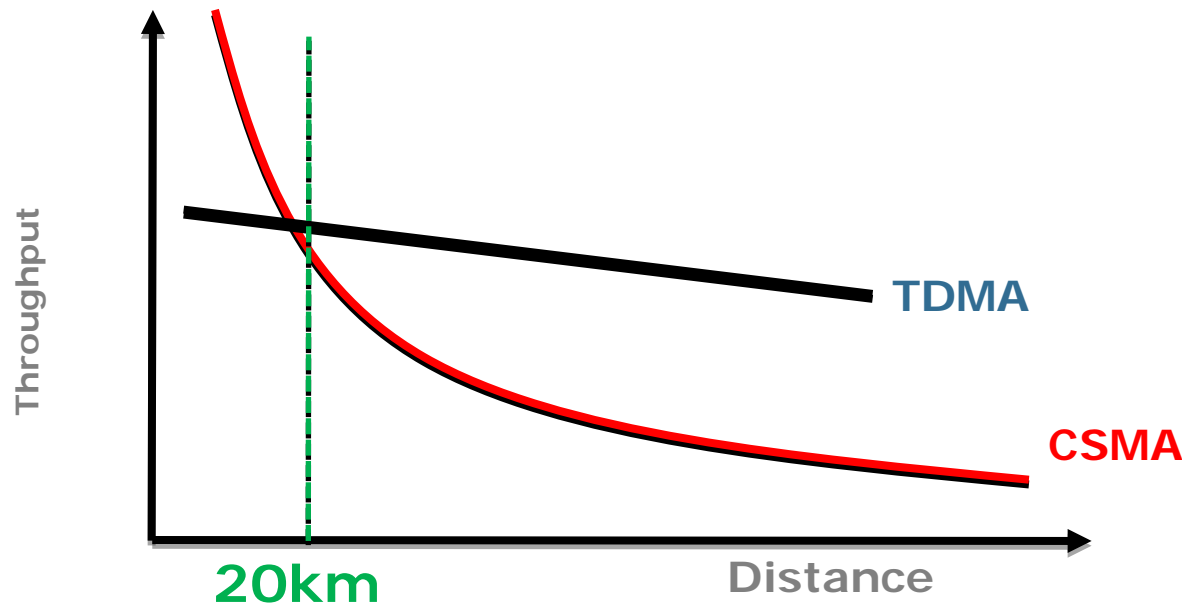
Due to ACK each successful data packet seems to take an 80km path causing poor performance, about < 1 Mbps



Reference result from Intel
About 20 Mbps @ 40km

CSMA vs. TDMA (2/2)

- CSMA is good for shorter distances
- TDMA is good for longer distances
- The boundary point is around 20 km

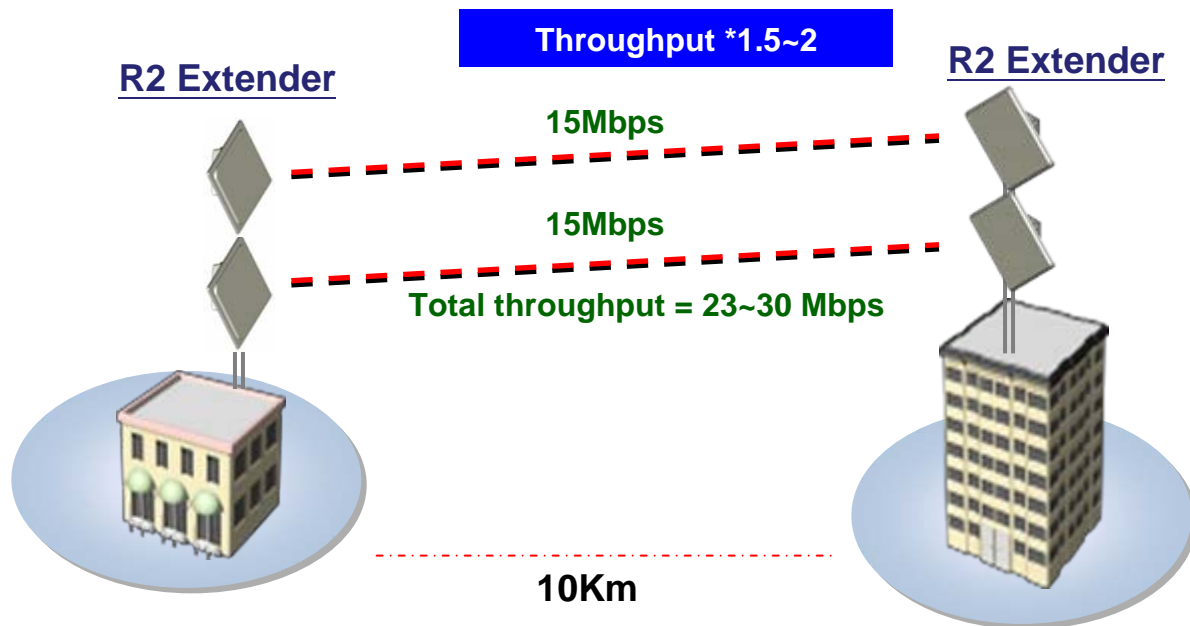


What is Link Aggregation (1/3)

- **A method of combining physical network links into a single logical link for increased bandwidth**
- **A set of two parallel physical links between two devices are grouped together to form a single logical link in order to increase capacity**

What is Link Aggregation (2/3)

- Two R2 Extender's are required for link aggregation
- Using P2P mode and enabling Link Aggregation the throughput will come close to doubling



What is Link Aggregation (3/3)

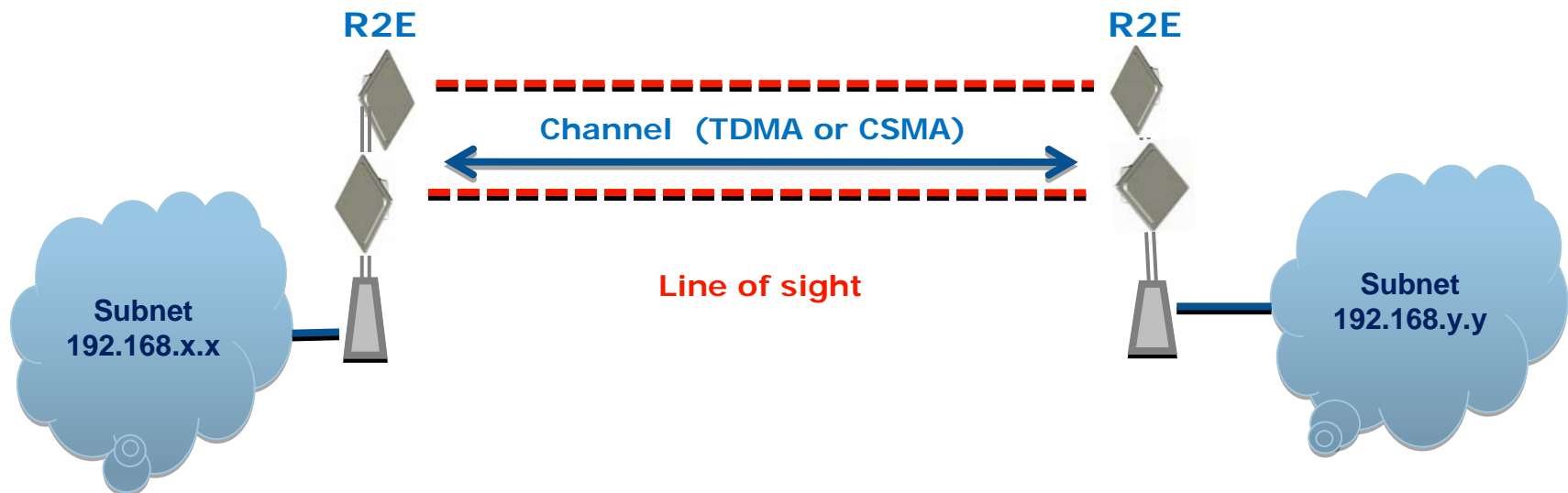
- **The advantages of Link Aggregation**
 - **Increased link capacity**
 - **Fewer towers needed to maintain bandwidth**
 - **Fewer towers equals less maintenance and more cost savings**

Operation modes

- **RCP connectivity options**
 - **Point to point**
 - **Point to Multipoint**
 - **RCP Relay**
 - **Point to Point with Local Coverage**

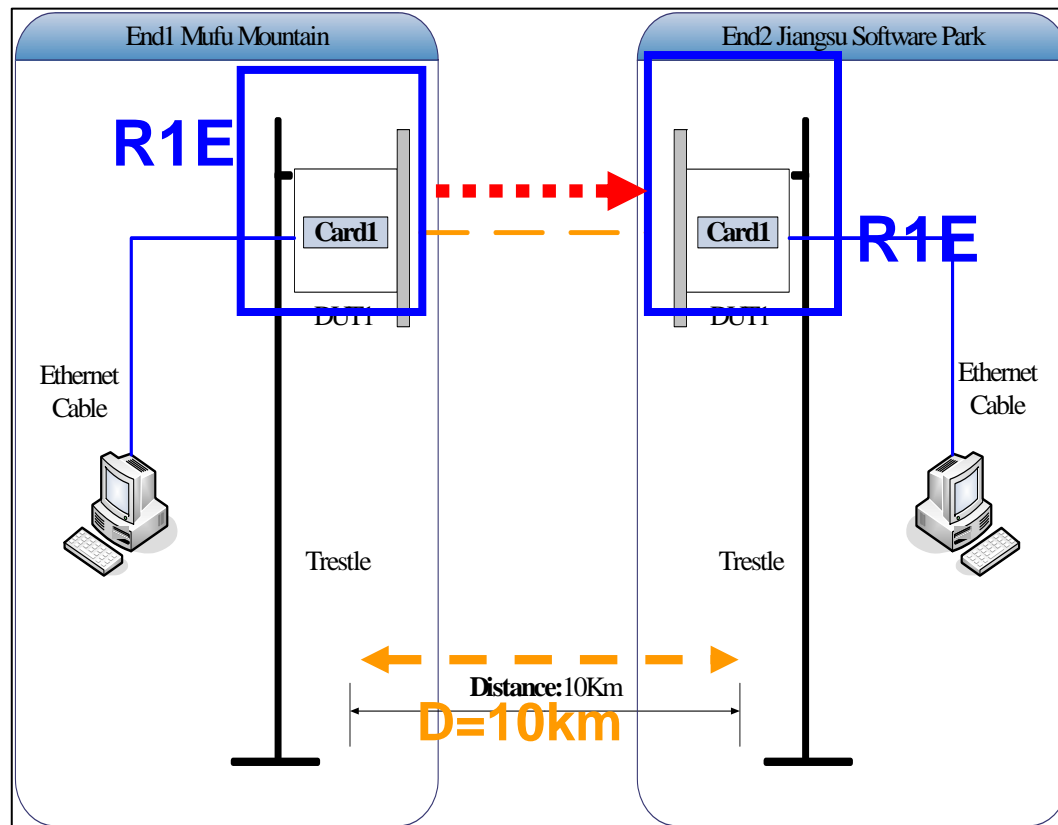
RCP connectivity option

- **Point to Point**
 - Peer to Peer connectivity between two locations
 - Enables the bridging of two networks
 - TDMA or CSMA (dependent upon distance)



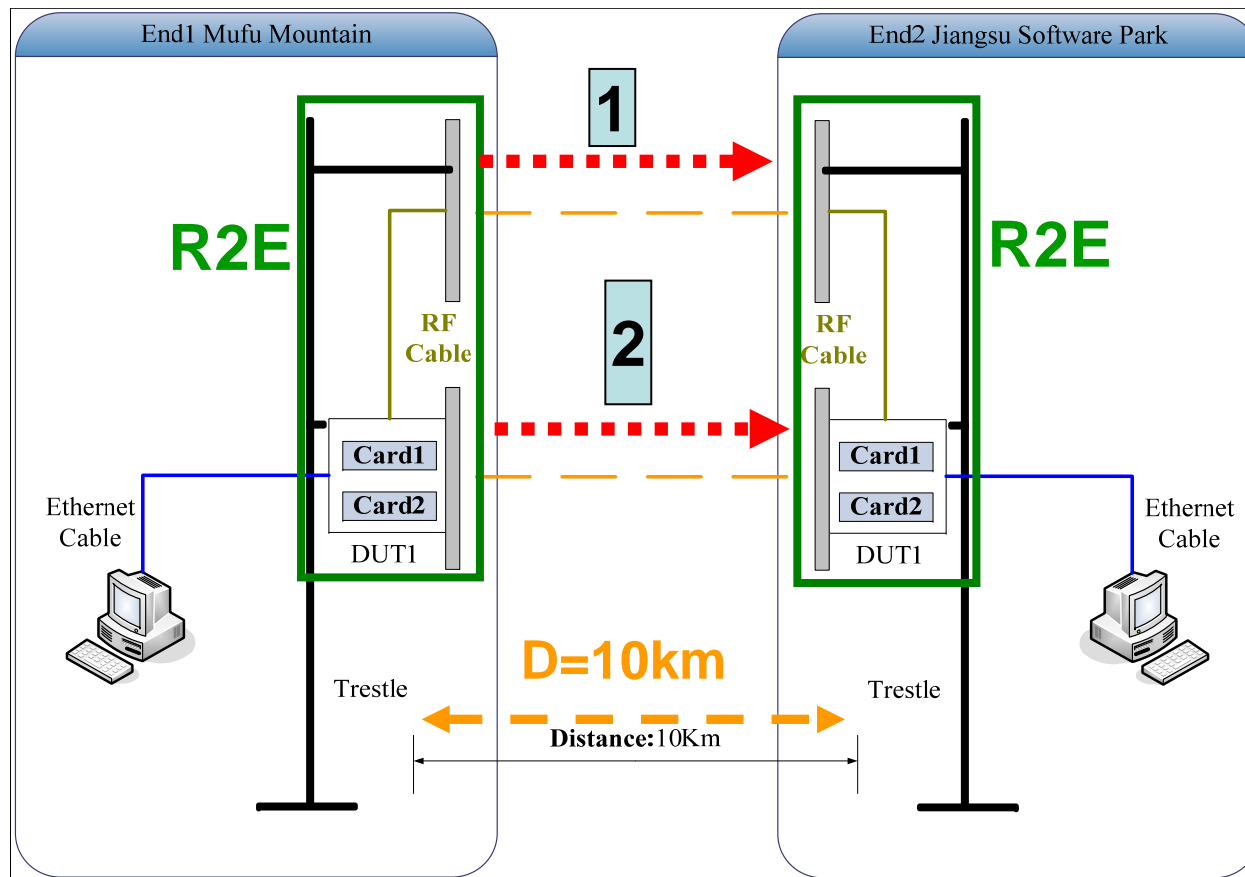
Point to Point Solution (1/2)

- R1 Extender P2P connectivity



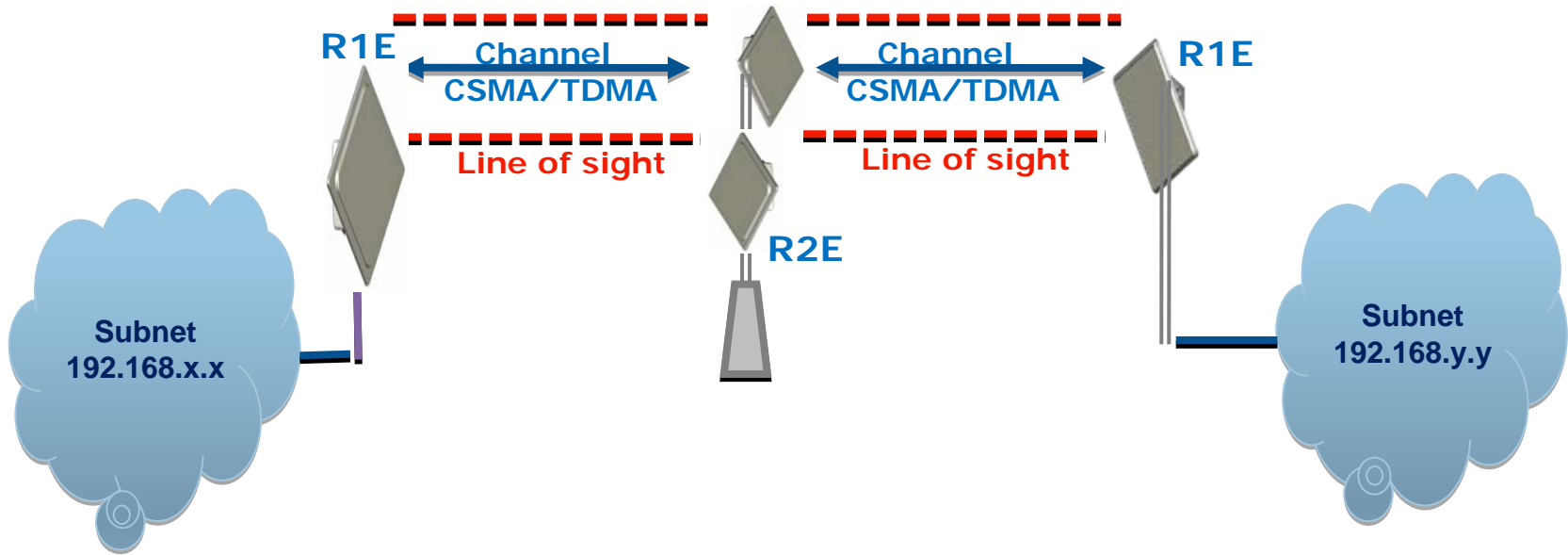
Point to Point Solution (1/2)

- R2 Extender P2P connectivity



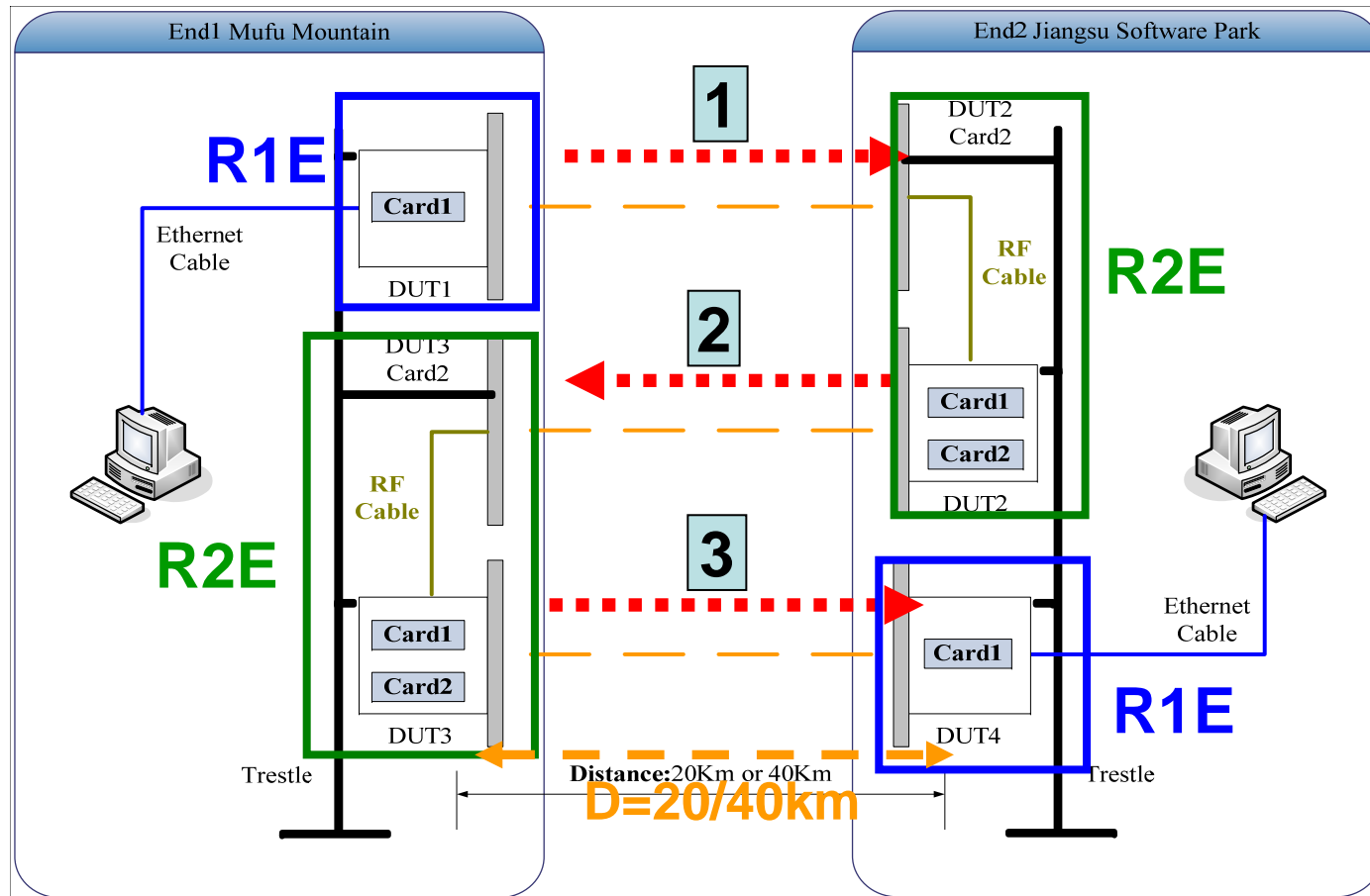
RCP connectivity option

- RCP Relay
 - Providing a means to reach more remote locations or bypassing obstacles like mountains or other line-of-sight issues



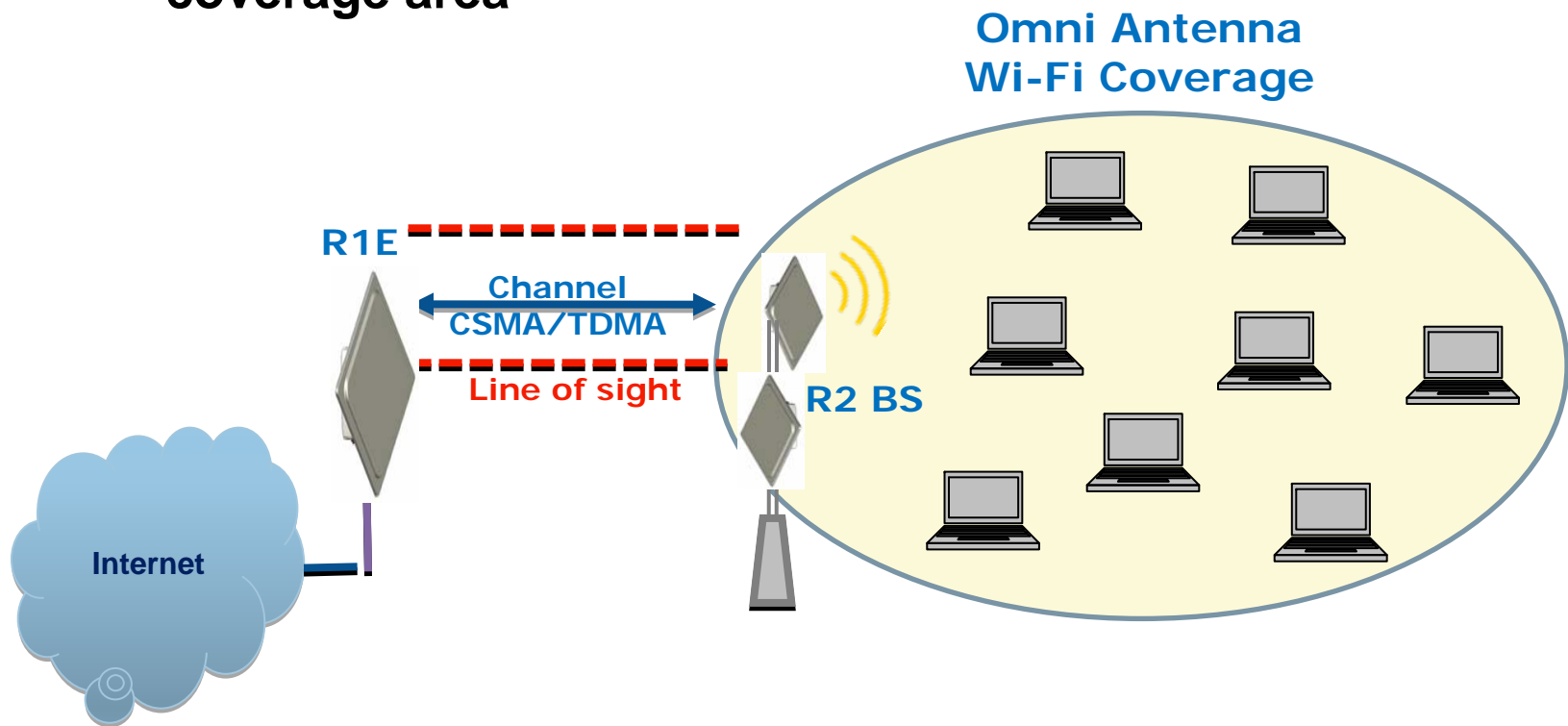
Relay solution

- R2 Extender Relay Bridge



RCP Connectivity Options

- **Point to Point with Local Coverage**
 - Provide local coverage from an RCP device to a specific coverage area



Hardware installation

- **RCP Interface Guide**
- **Adjusting the Antenna**

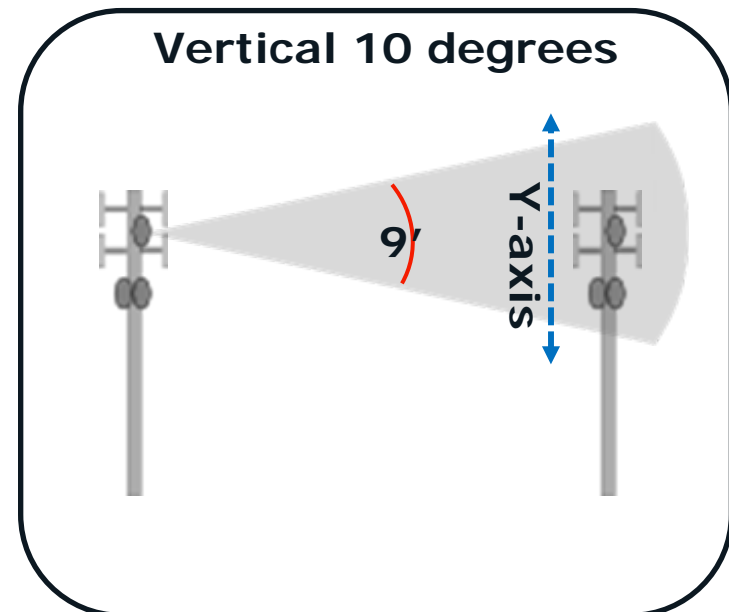
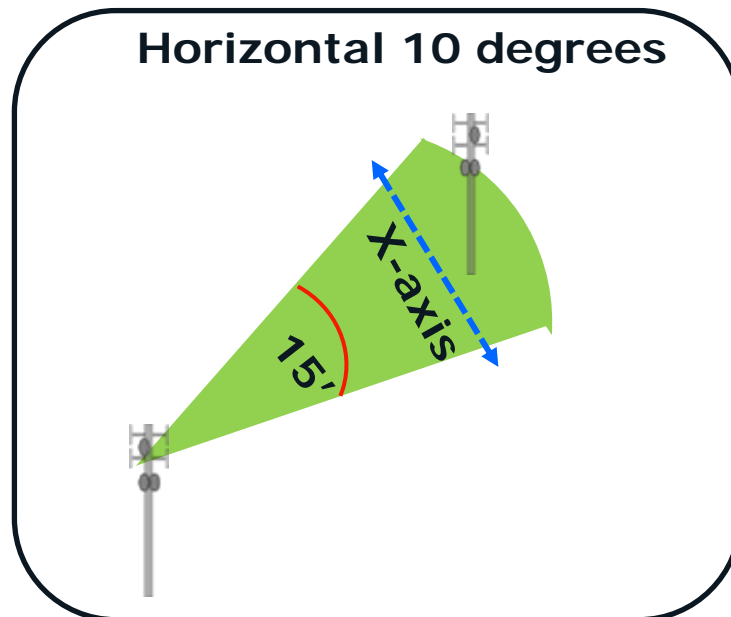
RCP Interface Guide

- Interface Definition



Adjusting the Antenna

- The directional antenna radiates energy in a tight beam
- RCP's antenna specs are: 10° vertical and 10° horizontal



Software configuration

- **Connecting to RCP from a laptop**
- **RCP Web Utility configuration**
 - **Login**
 - **Web interface / About page**
 - **Basic setup**
 - **Advanced setting**
 - **Security**
 - **Firmware update**
 - **Application- connection setting**

Login to the web interface

- Open an Internet Explorer session
- Enter the default IP address **192.168.1.1**
- Name = **admin**
- Password = **password**

Name

Password

Login the web interface

- Once you have logged in. You will find 4 options “System”; “Wireless”; “Status”; “Management”
- Click on “System → About” to see the basic information about your RCP unit

The screenshot displays the web interface with a top navigation bar containing four tabs: System, Wireless, Status, and Management. The 'System' tab is selected. On the left side, there is a sidebar menu with three items: 'About' (with a double arrow icon), 'Basic', and 'RADIUS Settings'. The main content area is titled 'About' and contains a section labeled 'Information' with the following details:

Wireless Device Name	DEVICE123456
ETH MAC Address	00:60:b3:12:34:56
WLAN1 MAC Address	00:60:b3:3c:ab:1a
Firmware Version	2.0.6

Basic setup (1/3)

- **System → Basic**
- **Enable “Spanning Tree Protocol”**
If you are “bridging” more than one RCP unit
- **When using two antennas, select “Link Aggregation” and “Full Duplex” for improved throughput**

Basic Setup

Wireless Device Name	<input type="text" value="DEVICE123456"/>
Country / Region	<input type="text" value="United States"/> ▼
Ethernet Data Rate	<input type="text" value="Automatic"/> ▼
Spanning Tree Protocol (STP)	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
Link Aggregation	<input type="radio"/> Enable <input checked="" type="radio"/> Disable

Full Duplex Two Channels

(Note: Link aggregation only takes effective when both cards work on P2P mode!)

Basic setup (2/3)

You can modify the RCP IP
Networking addresses here

IP Settings

Manual DHCP Client

IP Address

192.168.1.1

IP Subnet Mask

255.255.255.0

Default Gateway

0.0.0.0

Primary DNS Server

0.0.0.0

Basic setup (3/3)

- Wireless → Radio
- **Operating modes** of the RCP unit which are “Base Station”, “CPE”, “Peer-to-Peer CSMA” and “Peer-to-Peer TDMA”
- You may select from different bandwidth options or Click **“Super mode”** for improved throughput

Radio Settings

Operating Mode	Peer-to-Peer(CSMA) <input type="button" value="Site Survey"/>
Wireless Mode	802.11a
Channel / Frequency	149 / 5.745GHz
Transmit Rate	Best
Output Power	100%
Band Width	20MHz
TDM Coordination	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
WMM Mode	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
	<input checked="" type="checkbox"/> Fast Frame
	<input type="checkbox"/> Burst
	<input type="checkbox"/> Compression

Advanced settings (1/4)

- **Wireless → Radio**
 - The device can adjust the proper ACK timeout value by specifying distance between two nodes
 - The default is 10,000m
 - We strongly recommend you leave other advanced settings at their defaults

Advanced Parameters

RTS Threshold (0-2346)	<input type="text" value="2346"/>
Fragmentation Length (256-2346)	<input type="text" value="2346"/>
Beacon Interval(20-1000)	<input type="text" value="100"/> ms
Distance In Meters (0-100000)	<input type="text" value="10000"/> m
TDM Coordination Time Slice (2-32)	<input type="text" value="4"/> ms

Advanced settings (2/4)

- **Wireless → PTP Setup**
 - **P2P or P2MP connectivity supports up to four remote wireless devices.**
 - **Antenna aligning is only available under point-to-point (CSMA) mode.**

Peer-to-Peer Links

Local MAC Address	00 : 60 : b3 : 3c : ab : 1a	<input type="button" value="Align Antenna"/>
Remote MAC Address 1	: : : : : :	
Remote MAC Address 2	: : : : : :	
Remote MAC Address 3	: : : : : :	
Remote MAC Address 4	: : : : : :	

Antenna Alignment Tool

Signal Strength:	<input type="text"/>
Current RSSI (dBm):	0
Target RSSI (dBm) :	<input type="range" value="0"/> -65
Transmit Packets:	0
Receive Packets:	0

Advanced settings (3/4)

- **Set the target RSSI**
- **Click on “Start” to observe the current RSSI according to distances**

Distance	RSSI	Bandwidth
3Km	-57~-59	20MHz
10Km	-63~-67	20MHz
20Km	-69~-72	20MHz
40Km	-70~-74	20MHz

Advanced settings (4/4)

- **Wireless → Security**
 - Multiple encryption methods
 - “Broadcast Wireless Network Name” – Selecting “No” will prevent the network SSID from being broadcast

Security Profile Configuration

Profile Definition

Wireless Network Name (SSID)

Broadcast Wireless Network Name (SSID)

 Yes No

Network Authentication:

Data Encryption:

Passphrase:

Key 1:

Key 2:

Key 3:

Key 4:

Wireless Client Isolation Mode

 Enable Disable

Measuring Signal Strength

- There are three methods to observe RSSI (dBm)
 - Wireless → Link test → Refresh
 - Status → Connection → Refresh (CPE model only)
 - Wireless → PTP setup → Align antenna (CSMA only)
- If RSSI measurement is below -80dBm, the RCP will not be able to connect
- RSSI-Beep frequency

RSSI	Beep Frequency
>-50	100 /1sec
-50~-60	50 /1sec
-60~-70	5 /1sec
-70~-80	2 / 1sec
-80~-90	1 /1sec
< -90	No beeping sound

Remote Management

- Management → Remote Management
- Two more options for device management, which are SSH (Secure Shell) and SNMP

Remote Management

Remote Console

Secure Shell (SSH) Enable Disable

SNMP

SNMP Enable Disable

Read Community Name

Write Community Name

IP Address to Receive Traps

Apply

Cancel

Upgrade Firmware

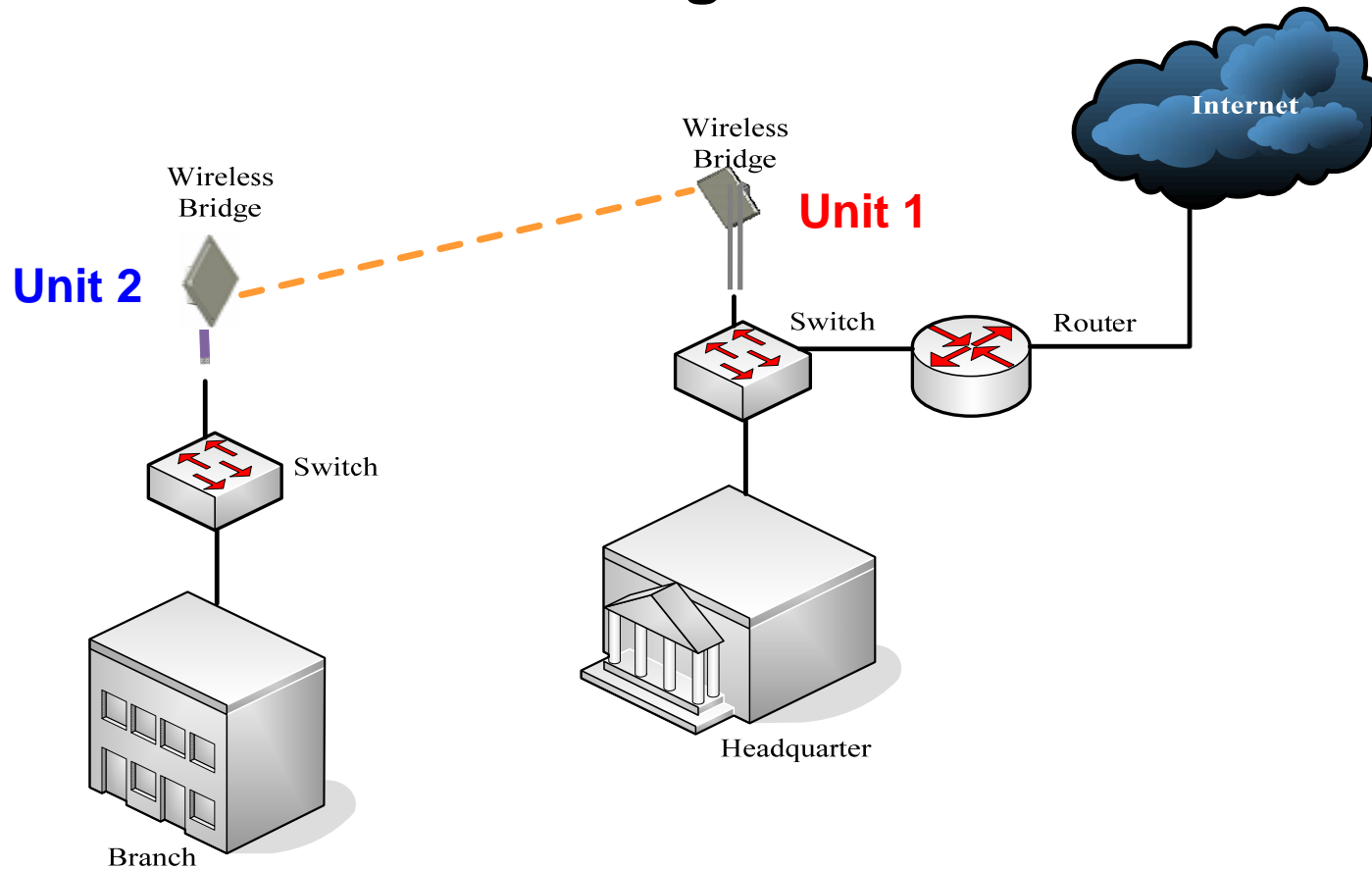
- Management → Upgrade Firmware
 - Click “**Browse**” to select the firmware file
 - Click “**Upload**” to load the file into device
 - Wait a moment, the system will reboot after successfully upgrade

Upgrade Firmware

Browse to locate the firmware file

Connection Setting

- P2P mode Setting



Connection Setting

- **P2P mode Setting**

- **Step 1: Select P2P Mode**

- **Wireless → RF1 → Radio → Operation Mode → P2P**

Radio Settings

P2P (CSMA)
P2P (TDMA)

Operating Mode	Peer-to-Peer(CSMA) ▾	Site Survey
Wireless Mode	802.11a ▾	
Channel / Frequency	149 / 5.745GHz ▾	
Transmit Rate	Best ▾	
Output Power	100% ▾	
Band Width	20MHz ▾	
TDM Coordination	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	
WMM Mode	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	
Super Mode	<input checked="" type="checkbox"/> Fast Frame	
	<input type="checkbox"/> Burst	
	<input type="checkbox"/> Compression	

Connection Setting

- P2P mode Setting
 - Step 2: U1 RF1 key in U2's RF1 MAC
 - Wireless → RF1 → P2P setup → key in U2's MAC

Peer-to-Peer Links

Key in U2's MAC →

Local MAC Address	00 · 60 · b3 · 3c · ab · 1a	
Remote MAC Address 1	<input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/>	Align Antenna
Remote MAC Address 2	<input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/>	
Remote MAC Address 3	<input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/>	
Remote MAC Address 4	<input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/> · <input type="text"/>	

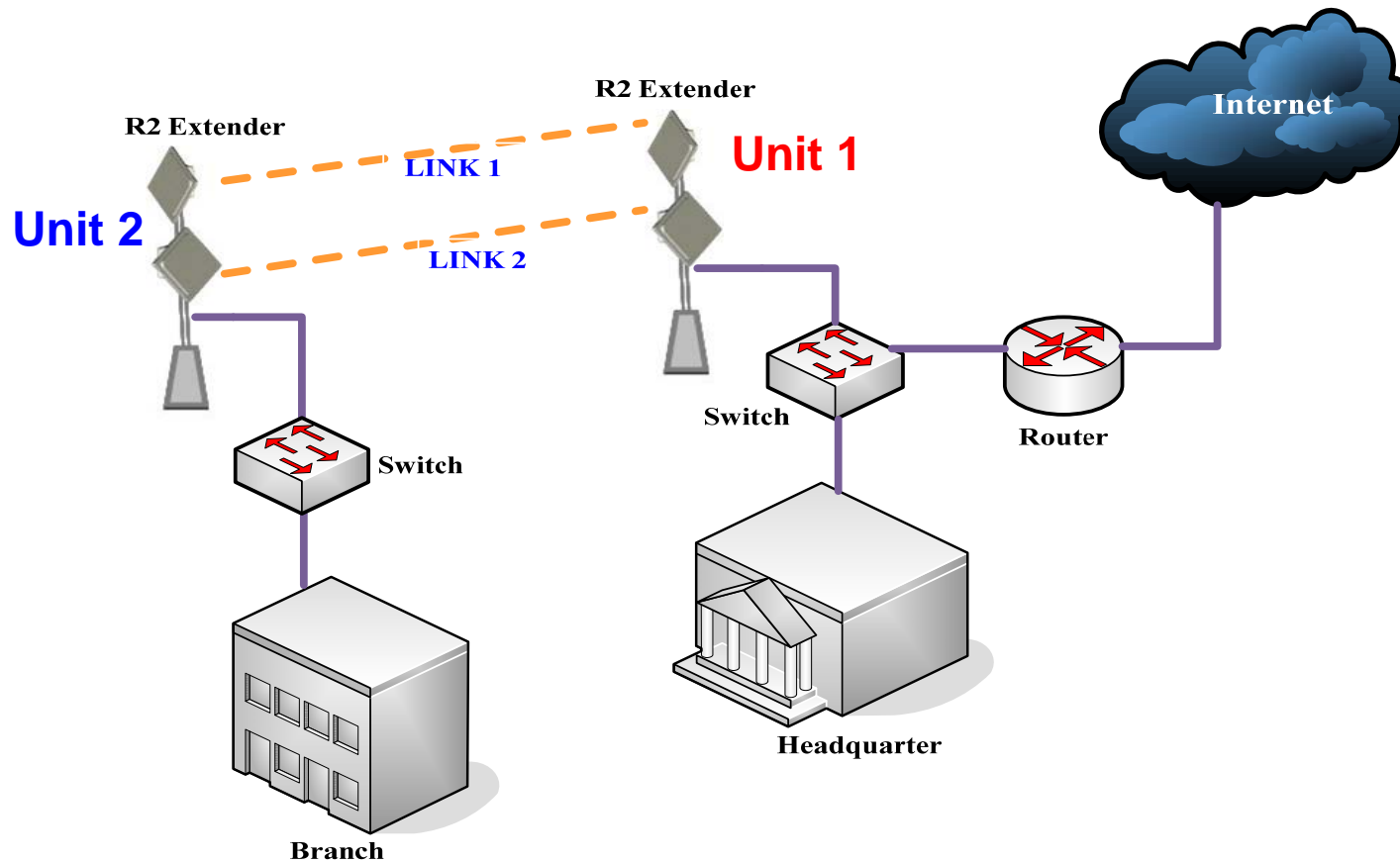
Connection Setting

- P2P mode Setting
 - Step 3: Check connection status
 - Wireless → Link test → Refresh
 - Wireless → PTP setup → Align antenna (P2P CSMA only)



Connection Setting

- Link Aggregation mode Setting



Connection Setting

- Link Aggregation mode Setting
 - Step 1: Enable Link Aggregation
 - System → Basic → Link Aggregation (R2E & CSMA only)

The screenshot shows the ZCOMAX Basic Setup configuration page. The 'Link Aggregation' section is highlighted with a red box. The 'Link Aggregation' section contains the following settings:

- Link Aggregation: Enable Disable
- Full Duplex Two Channels
- (Note: Link aggregation only takes effective when both cards work on P2P model)

Other settings visible on the page include:

- Wireless Device Name: DEVICE123456
- Country / Region: United States
- Ethernet Data Rate: Automatic
- Spanning Tree Protocol (STP): Enable Disable
- IP Settings: Manual DHCP Client
- IP Address: 192.168.1.1
- IP Subnet Mask: 255.255.255.0
- Default Gateway: 0.0.0.0
- Primary DNS Server: 0.0.0.0

Connection Setting

- Link Aggregation mode Setting
- Step 2: U1 RF1 → U2 RF1 MAC
U1 RF2 → U2 RF2 MAC
- Step 3: Check connection status

Wireless → PTP setup → Align antenna

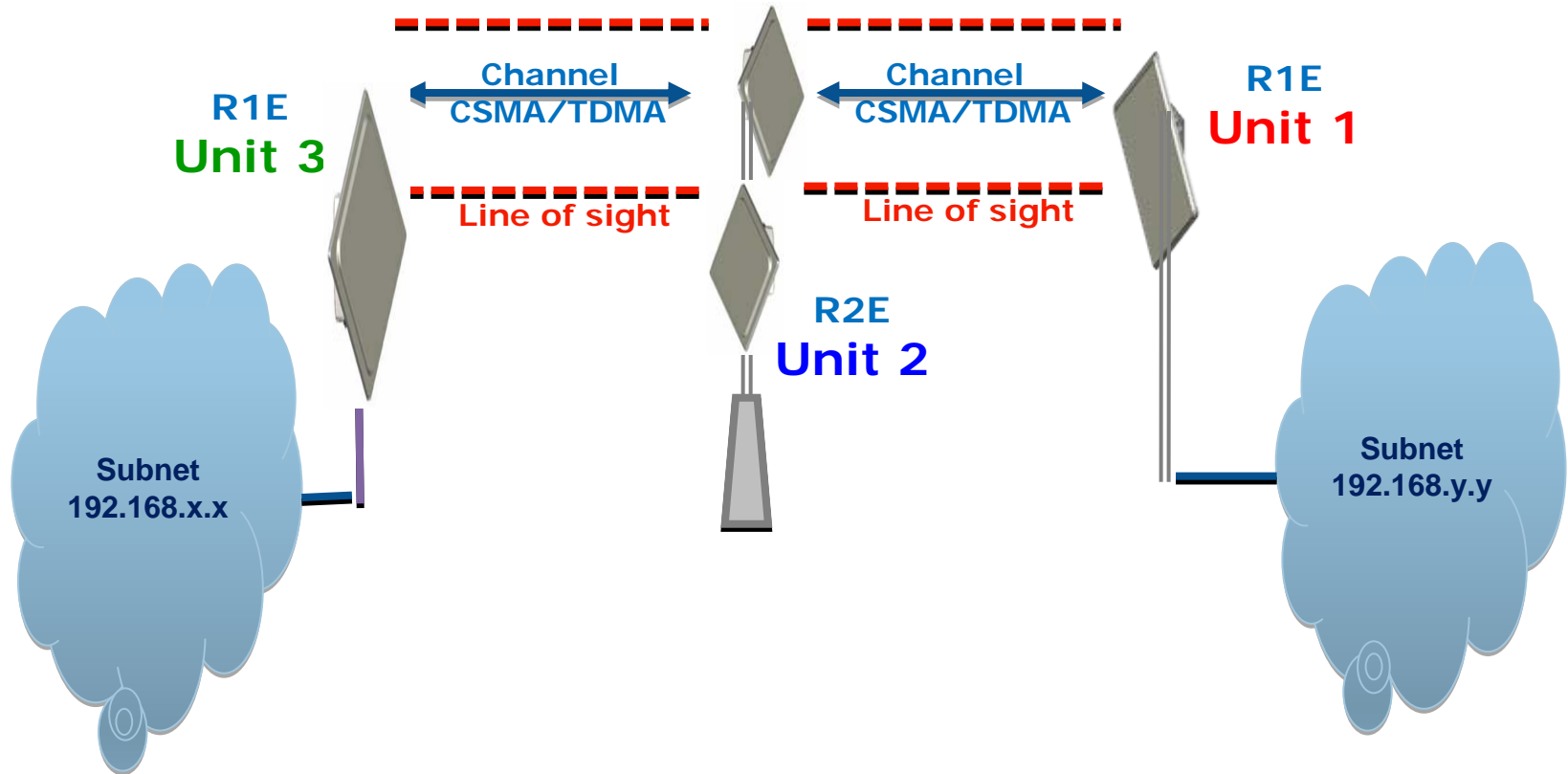
Antenna Alignment Tool (WLAN 1)

Signal Strength:	<input type="text"/>
Current RSSI (dBm):	0
Target RSSI (dBm):	<input type="range" value="-65"/> -65
Transmit Packets:	0
Receive Packets:	0

Start

Connection Setting

- Relay model Setting



Connection Setting

	RF	Setting	Mode
Unit 1 (R1E)	RF1	Connect to/Key in U2 RF1 MAC	P2P CSMA / TDMA
Unit 2 (R2E)	RF1	Connect to U1 RF1 MAC	P2P CSMA / TDMA
	RF2	Connect to U3 RF1 MAC	P2P CSMA / TDMA
Unit 3 (R2BS)	RF1	Connect to U2 RF2 MAC	P2P CSMA / TDMA
	RF2	Local coverage	Base Station