

EL-N Series PTP Mesh Backup Ring Wireless AP / STA / PTP MESH

Product Model:

IOP-EL-N-1 (1 RF Module)

IOP-EL-N-2 (2 RF Module)

IOP-EL-N-3 (3 RF Module)



Product Model:



EL-N-1



EL-N-2



EL-N-3

User Manual

Version : 1.4_GM

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1. Introduction

EL-N series products include EL-N-1 single radio dual band frequency RF module, EL-N-2 dual radio dual band frequency RF module and EL-N-3 three radio dual band frequency RF module three models of products, with high efficiency, high stability, 100% can completely replace the physical wired network Feature, the node and other node between the use of radio frequency to point to point wireless connection, you can quickly establish a wireless hops connection to extend the scope of application, unique PTP Mesh Backup Ring loop network mechanism to make the overall wireless communication system Increase the availability and stability.

■ EL-N system features:

- ◆ Radio frequency can be operated between 2.3 ~ 2.7GHz and 4.9 ~ 6.1GHz frequency band
- ◆ Applicable external 2x2 MIMO and 1x1 SISO antenna system
- ◆ single RF module, dual RF module or three RF module can be selected different radio frequency models
- ◆ Selectable 10MHz, 20MHz or 40MHz operating bandwidth
 - The longest distance: 40MHz band width of 20km; 20/10MHz band width of 50km above.
 - The highest performance is: point to point TX/RX total TCP 200Mbps bandwidth
 - Point-to-point bidirectional Video Streaming 220Mbps
 - Point-to-point bidirectional multicast / broadcast 240Mbps
 - 8 hops in series bidirectional TCP 150Mbps
 - 12 hops in series bidirectional TCP 140Mbps
 - 16 hops in series bidirectional TCP 125Mbps

EL-N unique PTP Mesh Hops with Ring backup mechanism, the use of RF point-to-point connection to establish a hops connection to extend the transmission distance, automatically establish a network of backup network system, automatic maintenance of multi-path recovery at the same time automatically avoid the formation of bad network Loop state.

EL-N combines PTP Mesh with unique forwarding platform mechanism, after many wireless relay forwarding, still have high-performance transmission capacity, suitable for a variety of applications, EL-N series support maximum relay forwarding hops of 250 jump (system design Must take into account the number of hops, transmission delay and overall performance).

EL-N's Extra Cost parameter setting, combined with the wisdom and human nature of the design, allowing users to arbitrarily specify the transmission path and backup path.

EL-N unique communication and closed architecture can block other illegal attempts to wireless connection, enabling AES high security wireless encryption to prevent wireless data being intercepted to monitor and steal.

EL-N with high-performance Multicast / Broadcast transmission features can greatly enhance the video multicast or broadcast benefits, increase the relevant applications.



EL-N is equipped with IGMP Snooping (v2 / v3) to improve the performance and practicability of the system in Multicast / Streaming applications.

EL-N provides 15 groups of VLAN-based QoS functions to prioritize data transmission.

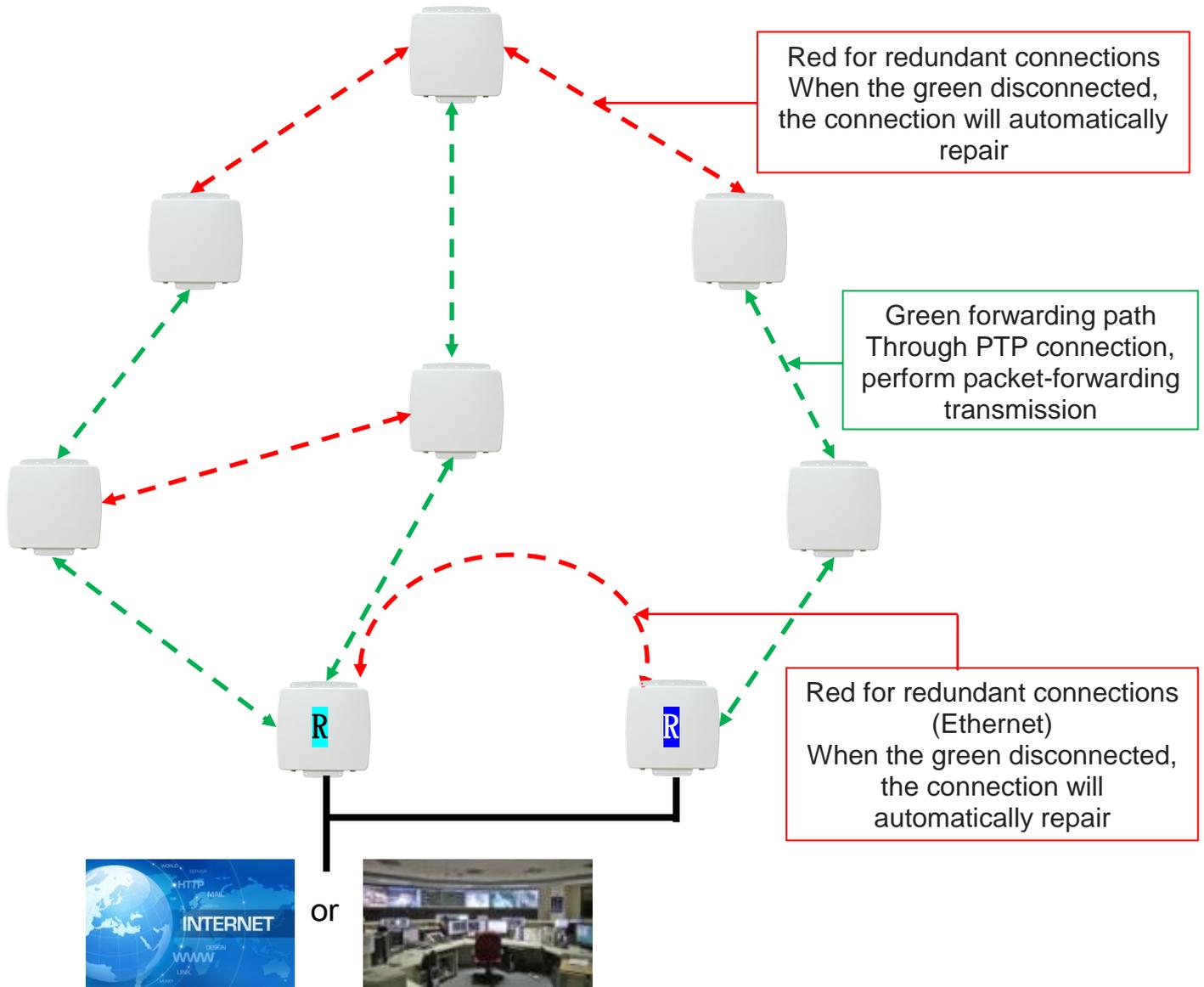
EL-N has a simple, clear and convenient operation interface, effectively enhance its use.

■ System operation features:

- ◆ Graphical system operation status display: can easily identify the wireless system connection status, signal strength, transmission rate, the operation of the wireless frequency and CPU processor load conditions ... and so on.
- ◆ Simple operation interface: the user can select a single page to set and input settings, easy to complete the system settings operation.
- ◆ Support to modify the product parameters: support customization to change their product name, product model, company LOGO, default account and password, default IP, the default start frequency ... and so on.

Mesh multipath network system structure and application diagram

■ EL-N Mesh multi-path network system architecture diagram



General Node

Root / Slave Node

Root / Master Node

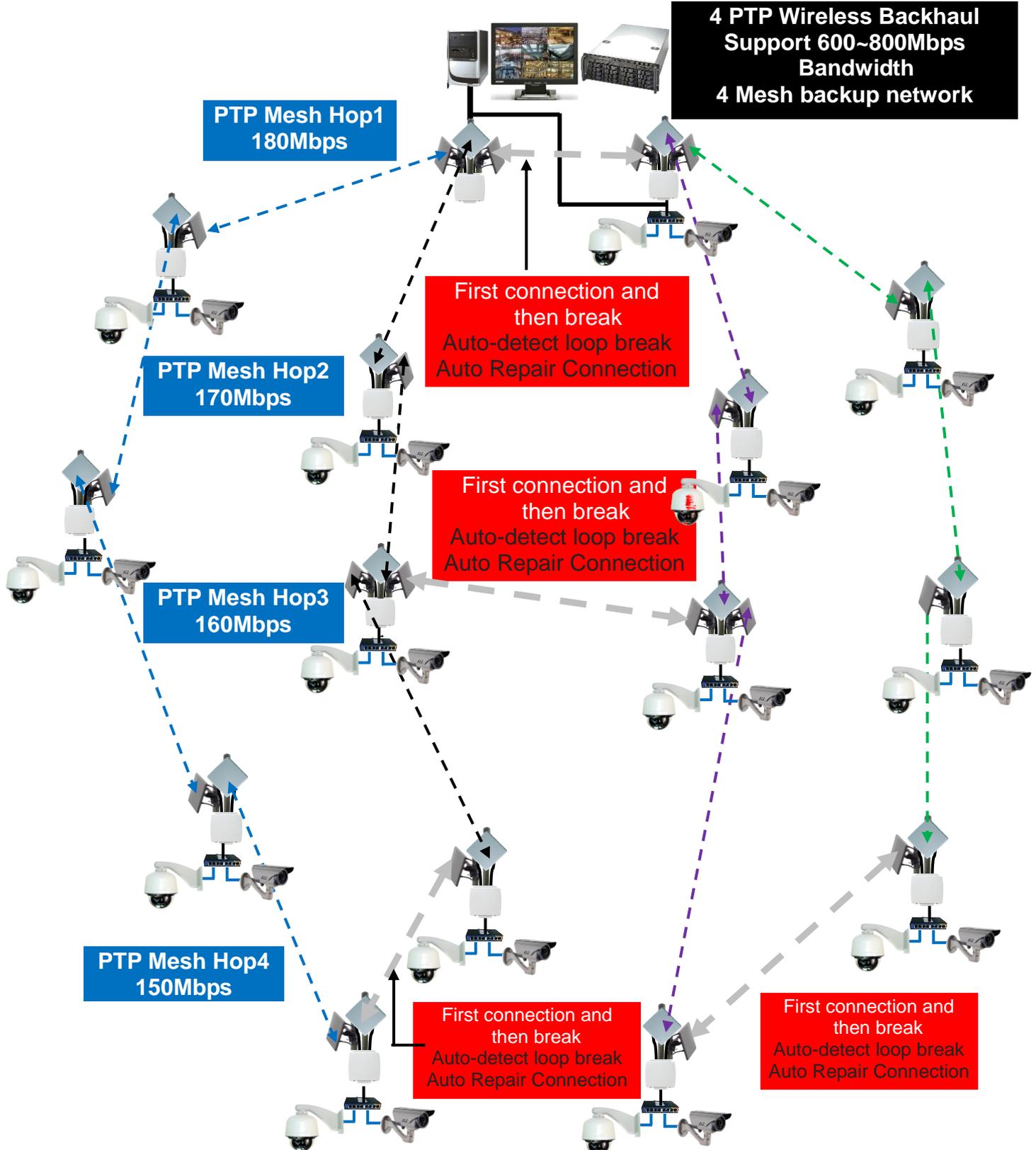
— Ethernet

← - - - → Forwarding Path

← - - - → Block / Backup Path

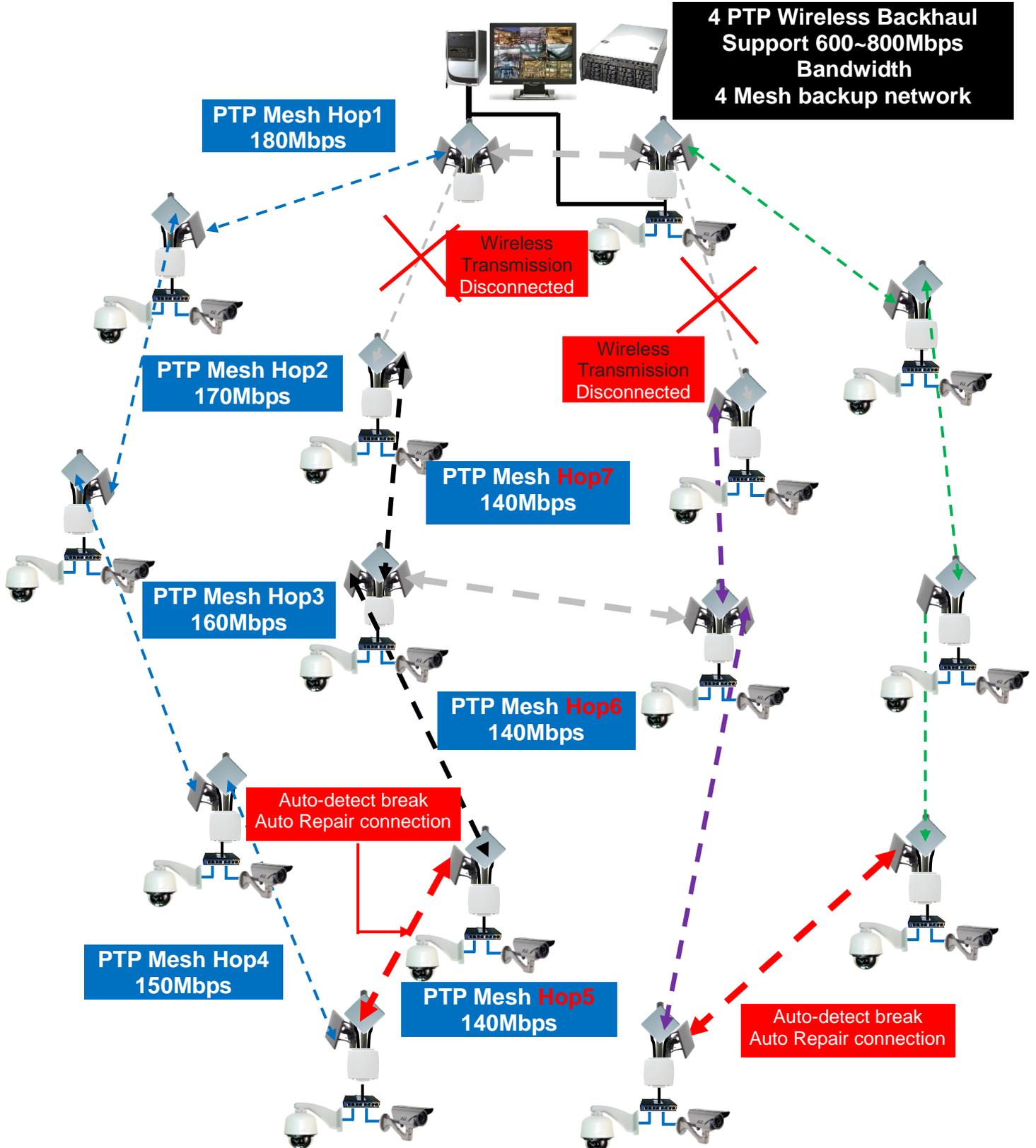
EL-N multipath of Mesh network architecture application diagram:

Wireless Mesh network structure extensible structure for backup system
Wireless surveillance system applied to the big city transport



EL-N Mesh multipath network "after disconnection, automatic backup connection" Application Diagram:

Wireless Mesh network structure extensible structure for backup system
Wireless surveillance system applied to the big city transport



2. Product appearance & antenna connector number

■ Product Appearance :



Product Model:



EL-N-1



EL-N-2

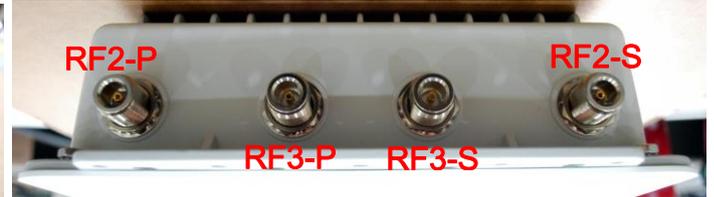


EL-N-3

■ MIMO 2X2 Antenna Connector Number



■ MIMO 2X2 Antenna Connector and Network Port - PoE Power Supply Hole



3. Wireless Antenna Installation & Power Supply

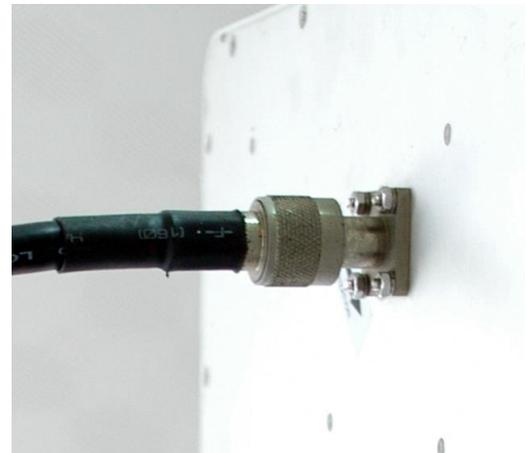
■ Wireless product system erection :



5GHz 20dBi MIMO Dual Polarization Antenna
PtP transmission distance of 0.05 ~ 5Km
Bandwidth traffic up to 150-200Mbps

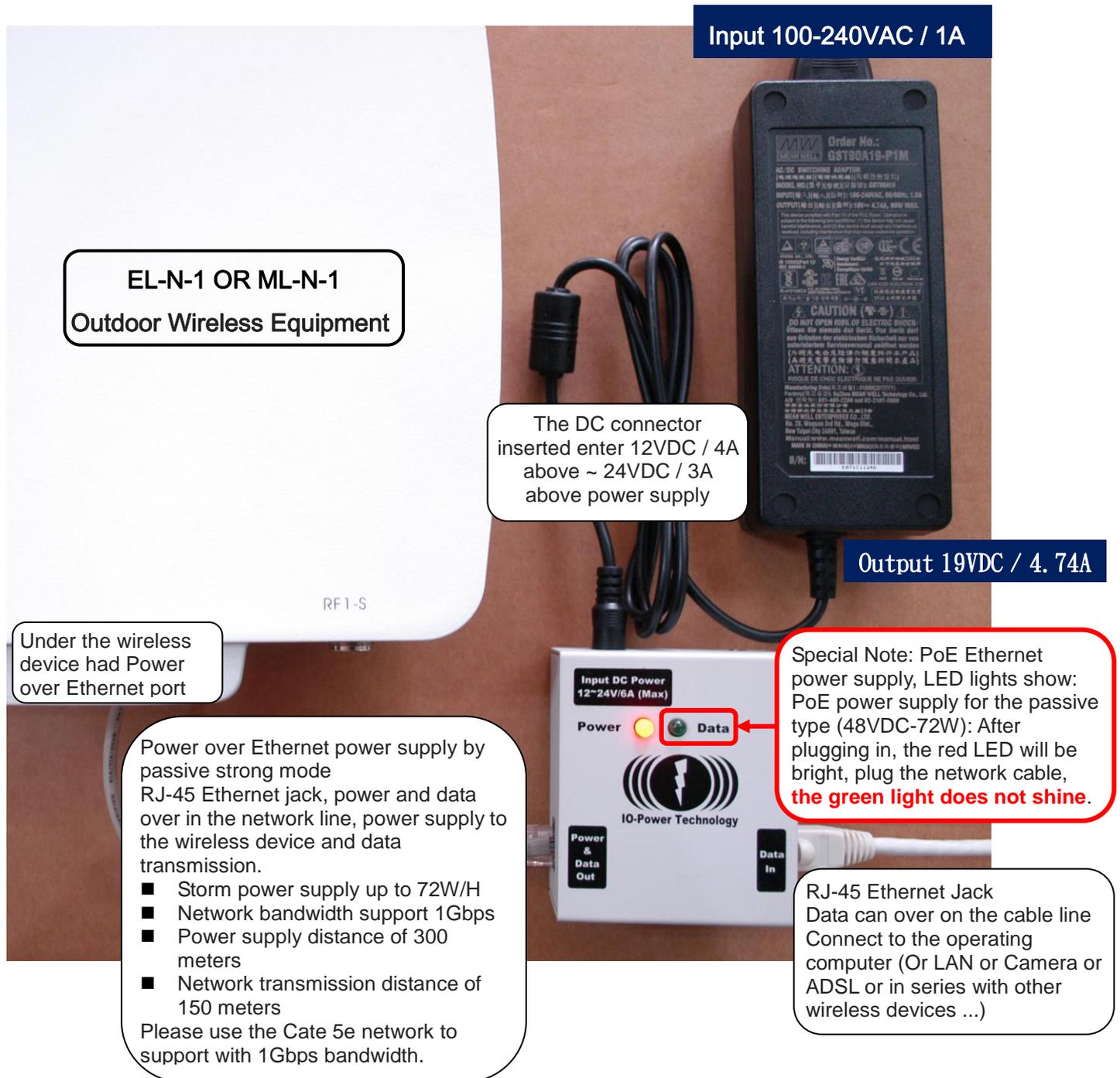
EL-N-1 OR ML-N-1
Outdoor Wireless Equipment

PoE-PSE
Ethernet Power Supply Cable



CFD-400 N-to-N Type
1.5 m Antenna Extension Cable

4. Accessories PoE through Ethernet Power Supply



Special Note: PoE power supply, LED lights show:

- PoE Ethernet power supply **strong passive mode (48VDC-72W)**: After plugging in, the red LED will light, plug the network cable, **the green light does not shine.**
- PoE Ethernet power supply standard mode (48VDC-32W): After the plugs, the red LED will be light, plug the cable, the green light will be bright.

- EL-N-1: basic operation power consumption 6W / H, 100Mbps full speed transmission 8W / H maximum, start the maximum power consumption 12W
- EL-N-2: basic operation power consumption 8W / H, 100Mbps full speed transmission 10W / H maximum, start the maximum power consumption 16W
- EL-N-3: basic operation power consumption 10W / H, 100Mbps full speed transmission 12W / H maximum, start the maximum power consumption 20W

5. First login

Connect the computer to the EL-N device, set the computer and the EL-N device as the same network segment IP address, open the computer web browser, and connect the EL-N device default URL to log in.

- The default IP address of the EL-N device is 192.168.1.1
- With the computer web browser to open the URL: <http://192.168.1.1>, you can log in



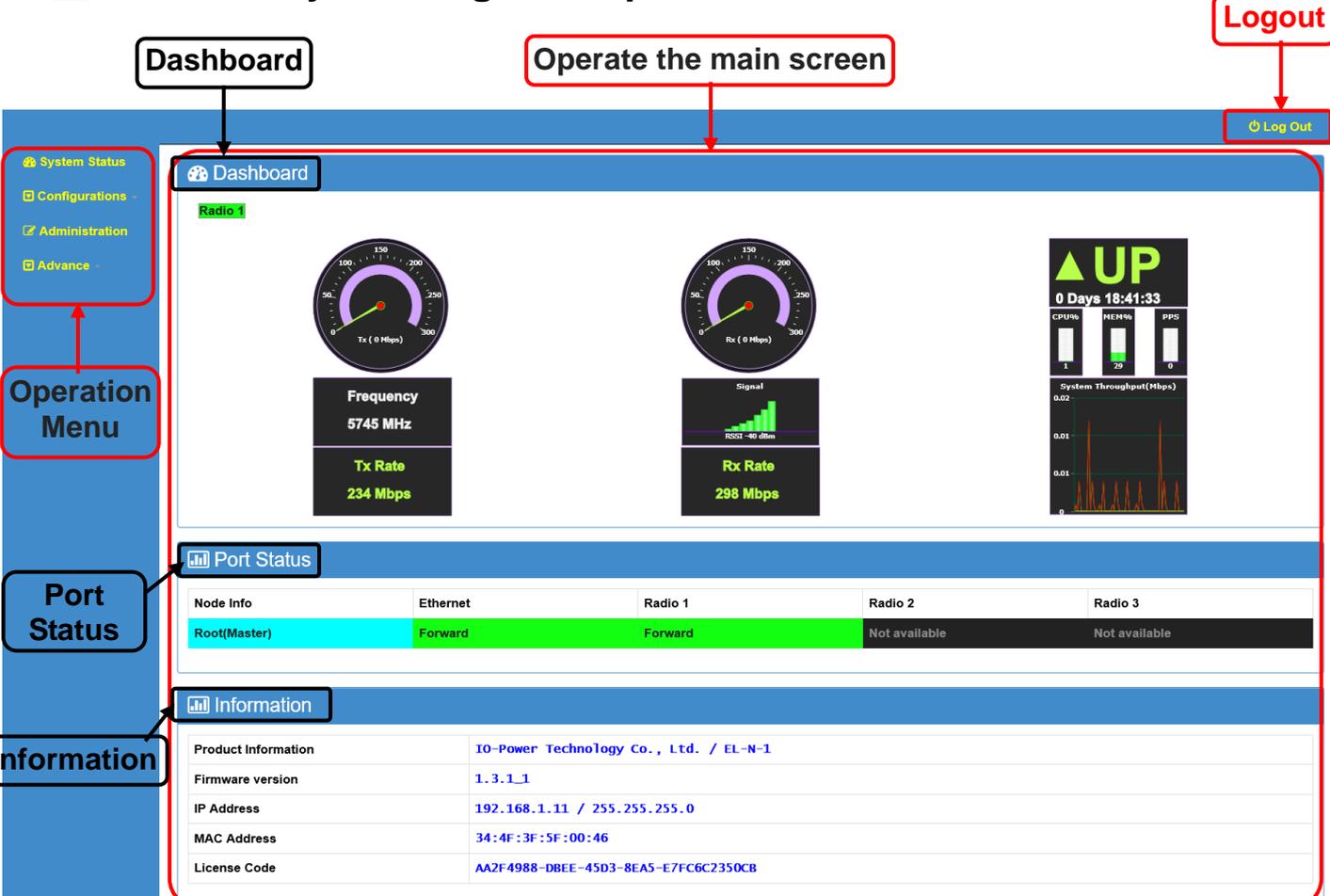
勁電科技
IO-Power Technology

- The default login account ID and Password for the EL-N device are: **admin / admin**
- ◆ At the same time, you can log in to the wireless device through the Web page, and there is no limit on the number of operators. Therefore, please note the order in which the operation parameters are set.
- ◆ The system operation screen of the wireless device does not perform any action within 5 minutes. The management system will automatically log out the operation page, return to the login account and password screen, you need to re-login account and password in order to re-wireless device system of the operation settings.

6. Start screen

The EL-N is an easy-to-use wireless point-to-point system that allows you to quickly and easily set up a wireless connection and create a point-to-point Mesh backup ring loop network communication system with a simple and easy GUI interface.

■ The EL-N system login complete screen is as follows:



The screenshot shows the EL-N system login complete screen. The interface is divided into several sections:

- Dashboard:** The main content area, highlighted by a red box and labeled "Operate the main screen". It contains:
 - Radio Section:** Two circular gauges for Tx (0 Mbps) and Rx (0 Mbps). Below them are labels for Frequency (5745 MHz) and Tx Rate (234 Mbps). A Signal gauge shows RSSI -40 dBm and Rx Rate (298 Mbps).
 - System Status:** A green "UP" indicator with "0 Days 18:41:33" uptime. Below it are three bar charts for CPU%, MEM%, and PPS. A line graph shows System Throughput (Mbps).
- Port Status:** A table showing the status of various ports. It is highlighted by a black box and labeled "Port Status".

Node Info	Ethernet	Radio 1	Radio 2	Radio 3
Root(Master)	Forward	Forward	Not available	Not available
- Information:** A table providing system details. It is highlighted by a black box and labeled "Information".

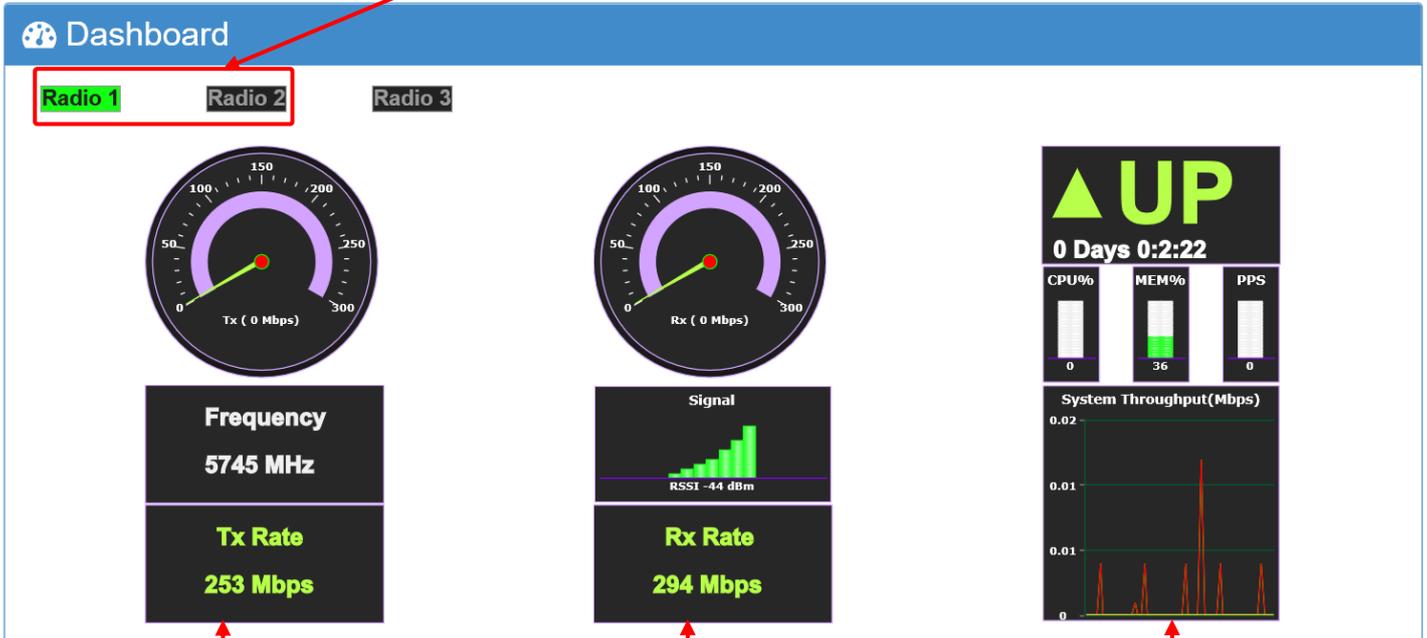
Product Information	IO-Power Technology Co., Ltd. / EL-N-1
Firmware version	1.3.1_1
IP Address	192.168.1.11 / 255.255.255.0
MAC Address	34:4F:3F:5F:00:46
License Code	AA2F4988-DBEE-45D3-8EA5-E7FC6C2350CB
- Navigation and Logout:**
 - A blue sidebar on the left contains menu items: System Status, Configurations, Administration, and Advance. A red box labeled "Operation Menu" points to this sidebar.
 - A "Logout" button is located in the top right corner, highlighted by a red box and labeled "Logout".
 - A "Log Out" button is located in the top right corner of the dashboard area, highlighted by a red box.

7. System Status

The system state is divided into three parts: Dashboard, Connect Status, and Information.

■ Dashboard: Shows the immediate operation of the system

Radio frequency module switching



◆ Wireless transmitter information and frequency

- Tx Data Rate (Mbps)
- Radio frequency (MHz)
- Tx Wireless Transmitter RF Usage Rate (Mbps)

◆ Wireless receiver information and signals

- Rx Data Rate (Mbps)
- Wireless signal strength (dBm)
- Rx Wireless Receiver RF usage rate (Mbps)

◆ System information

- System operation time
- CPU usage status (%)
- MEM memory usage status (%)
- PPS per second Ethernet out of the number of packets
- System Total Flow Rate (Mbps)
 - Green: total traffic
 - Red: wireless launch
 - Yellow: wireless reception

■ Port connection status: Displays the node device and the interface port status of each interface

◆ Mesh mode connection status display

Node Info	Ethernet	Radio 1	Radio 2	Radio 3
Root(Master)	Forward	Forward	Forward	Forward

Node Info	Ethernet	Radio 1	Radio 2	Radio 3
Normal(Connected)	Down	Fwd(1 2)	Not available	Not available

Node Info	Ethernet	Radio 1	Radio 2	Radio 3
Normal(Connected)	Down	Fwd(1 2)	Not available	Not available

◆ Node state:

- Main Root equipment
- Secondary root equipment
- General equipment (connected)
- General equipment (not connected)

Description: Root Master and Root Slave role definition, by the software automatically detect and judge to the wired network export as the main basis for judging.

◆ Wired network --Ethernet / Wireless network --Radio:

- Transfer in transit (normal path)
- Transfer in route (backup path)
- Not connected (broken path)
- No offer (not inserted wireless card)

Note: Forward / Blocked / Down state, if there is a numerical value, that this path has set the Extra extraordinary value, used to change the path state, the value of n / m, respectively, that the Root device for the n Jump, Cost is m.

Fwd(2/17): The root device is 2 hop, and the 2-hop accumulated cost of the root is 17.

Bkd(3/29): The root device is 3 hop, and the 3-hop accumulated cost of the root device is 29.

◆ How to use n Jump and m Cost for Charges:

- N hop: refers to the number of times to reach the Root device, is determined by the system automatically detect, when a device failure or connection is interrupted by interruption, PTP Mesh Ring backup mechanism starts, Mesh system will automatically re-estimate the different transmission The number of jumps on the path, as the basis for determining the cumulative cost of the decision to repair the connection.
 - 1st to 4th jumps, 1 bonus per 1 increase.
For example: the 1th jump 1 fee, the 2th jump $1 + 1 = 2$ cost, the 3th jump $2 + 1 = 3$ cost, the 4th jump $3 + 1 = 4$ cost
 - 5 to 8 jump, each 1 platform to increase the 2 cost points.
For example: the 5th jump $4 + 2$ costs, the 6sixth jump $6 + 2 = 8$ cost, the 7th jump $8 + 2 = 10$ cost, the 8th jump $10 + 2 = 12$ cost
 - 9 to 12 jump, each 1 platform to increase the 3 cost points.
For example: the 9th jump $12 + 3$ costs, the 10th jump $15 + 3 = 18$ cost, the 11th jump $18 + 3 = 21$ cost, the 12th jump $21 + 3 = 24$ cost; and so push the subsequent jump costs.
- M Cost: Extra Cost is set up by the system users, according to the Mesh system automatically repair the connection path, the user special purpose of the mandatory interference to increase the cumulative cost points to change the Mesh system backup connection repair Connection path.
- Extra cost points can be imported from 1 to 30000 cost points.
- The cumulative cost of switching the backup path, the gap will be 5 cost points and will be implemented.

◆ AP / STA mode connection status display

Connection Status				
MAC	RSSI(dBm)	Throughput(T/R)(bps)	Total Data(T/R)(Bytes)	Connected Time
34:4F:3F:5F:00:49	-43	0.000 /0.000	6.013K/0.000	0 Hours 00 Min 58.4 Seconds

- MAC: connect to the AP client MAC address
- RSSI: connected to the AP connection client signal strength (dBm)
- Throughput: AP and the client to each other to send / receive real-time traffic bandwidth
- Total Data: The total amount of data transferred and received by the AP and the client
- Connected Time: The cumulative time for the client to connect to the AP



■ Device message: Displays basic device information

Information	
Product Information	IO-Power / EL-N-3
Firmware version	1.3.1_e
IP Address	192.168.1.1 / 255.255.255.0
MAC Address	34:4F:3F:5F:00:52
License Code	FB7341D2-0CB8-4406-85B0-D538EADFA350

- ◆ Firmware Version: Device Software Version
- ◆ IP address: IP address of the device / network segment
- ◆ MAC address: Ethernet MAC address of the device
- ◆ License Code: Device copyright code

8. System settings

The system setting is divided into Mesh mode / AP mode / STA mode according to the operation mode of the device

■ Mesh mode setting:

Mesh mode settings are divided into: Global, Network and Radio.

◆ Mesh mode - Global settings:

Global	
Device Info	<input type="text" value="device info"/>
Group ID	<input type="text" value="1"/>
LINK ID	<input type="text" value="EL-N Link"/>
Security	<input type="checkbox"/> <input type="text" value="secretkey"/>
Root Device	<input type="text" value="Enable"/> <input type="button" value="v"/>
Longitude(-180.000000 ~ 180.000000)	<input type="text" value="0"/>
Latitude(-90.000000 ~ 90.000000)	<input type="text" value="0"/>

- Device information: by the erection system users to enter their own to identify the set of wireless devices.
- Group identification code: default is 1
Note: The same group ID can be linkable
- Link ID: Adjacent node connection ID
Note: Connected must be used same Link ID.
- Security encryption: default password 12345678; check Enable / Uncheck to close the encryption; check the password can be entered by their own settings.
- Root device: Enables / disables the root node
**Note1: There must be at least one root node device in the group to operate.
It is generally recommended to set the egress node as the primary root node--Master.
If there are two egresses, the secondary root device--Slave can be set to form Multi-Ring backup node architecture.**
Note 2: When the multi-point relay jumper circuit is set up, if there is only one root node in the group, it is easy to have a system interruption when the other end of the system does not have any root device. The system device cannot be connected to the Web UI settings. In this case, the wireless device connected to the wired network must be started as a root device to connect the devices in other system groups.

Note 2: When the multi-point relay jumper circuit is set up, if there is only one root node in the group, it is easy to have a system interruption when the other end of the system does not have any root device. The system device cannot be connected to the Web UI settings. In this case, the wireless device connected to the wired network must be started as a root device to connect the devices in other system groups.

Note 3: There may be multiple root devices in the entire group system. Therefore, it is recommended to start all devices as root devices during initial setup. After the system is working properly, reduce the root node. (Root) the number of devices.

- Longitude: Setting Longitude
- Latitude: Setting Latitude

◆ Mesh mode - network settings:

Network	
IP address	192.168.1.11
Netmask	255.255.255.0
Default Gateway	0.0.0.0
Management VLAN ID	0
IGMP Snooping	Enable <input type="checkbox"/>
Ethernet Extra Cost	0

- IP address: Device Ethernet IP address.
- Network segment cover Netmask: default is 0.0.0.0.
- Preset gateway: gateway address.
- Manage VLAN ID: Set the management VLAN ID.
- IGMP Snooping: Enables / Disables the multicast packet management mechanism
 - When your system uses broadcast packet transmission, it is easy to form a network storm in the wireless transmission system or cause the CPU load is too large, causing the device to crash; start IGMP can solve such broadcast packet transmission and network storm problem.
- Additional cost of Ethernet: Increase the extra cost of the Ethernet path
 - Increase the cost parameter integral of the Mesh network transmission path through the Extra cost. The control of the decision path and change the backup path is achieved.
 - Path costs are mainly based on the number of jumps and RSSI and the path fluency as a parameter cost definition, as the best transmission path and the original path to determine the basis.
 - Extra cost points can be entered from 1 to 30000 cost points.
 - The cumulative cost of switching the backup path, the gap between the five cost points will be implemented.

◆ Mesh mode - Radio setting:

Radio 1	
Radio	MESH
Parameters	40 MHz, 2x2 MIMO, 400ns GI
Tx Power Level	Maximum
Frequency(MHz)	5745 (Frequency Range: 4920 ~ 5150 ~ 5850 ~ 6080)
Distance(km)	1
Extra Cost	0

- Radio card (wireless module): have MESH or AP or STA mode, please select MESH mode.
 - OFF: Turn off the wireless interface operation, when the wireless card module is not used, it is recommended to close the card interface, in addition to reducing power consumption, can also reduce the risk of wireless interference.
 - AP: Set to AP base station (server / receiver)
 - STA mode: Set to STA-Station platform side (client / transmitter)
 - MESH: Set to multi-path backup wireless transmission function
- Parameters: Set radio frequency parameters, including 10MHz / 20MHz / 40MHz wireless band use width, 2x2 MIMO / 1x1 SISO antenna system, 400ns / 800ns GI interval (The distance between the two ends of the selected radio frequency width 10MHz / 20MHz / 40MHz must be consistent, otherwise can not connect.)
- Output power level: Wireless transmit power level (Every 3dBm will upgrade one times)
 - Transmission power size level is divided into:

Maximum – Max	Half-1/2	Quarter-1/4
Eighth-1/8	Sixteenth-1/16	Minimum-Min
- Use frequency: The use of direct input frequency mode settings, if the input frequency is wrong, the system will automatically select the closest frequency to use. You can also refer to the frequency range display frequency area.
- Distance parameter (Km): 1Km for the distance between the parameter units (1Km within the default value of 0)
- Extra Cost: This is the radio frequency in the system transmission, by artificially set additional costs, to interfere with the increase in the transmission path parameters cost points, to determine the path and change the backup path control.
 - Extra cost points can be entered from 1 to 30000 cost points.
 - The cumulative cost of switching the backup path, the gap between the five cost points will be implemented.

■ AP mode setting:

The AP mode setting includes Global, Network and Radio.

◆ AP mode - Global settings:

Global	
Device Info	<input type="text" value="device info"/>
Longitude(-180.000000 ~ 180.000000)	<input type="text" value="0"/>
Latitude(-90.000000 ~ 90.000000)	<input type="text" value="0"/>

- Device information: by the erection system users to enter their own to identify the set of wireless devices.
- Longitude: Setting Longitude
- Latitude: Setting Latitude

◆ AP mode - Network settings:

Network	
IP address	<input type="text" value="192.168.1.11"/>
Netmask	<input type="text" value="255.255.255.0"/>
Default Gateway	<input type="text" value="0.0.0.0"/>
Management VLAN ID	<input type="text" value="0"/>
IGMP Snooping	<input type="text" value="Enable"/> <input type="checkbox"/>

- IP address: Device Ethernet IP address.
- Network segment cover Netmask: default is 0.0.0.0.
- Preset gateway: gateway address.
- Manage VLAN ID: Set the management VLAN ID.
- IGMP Snooping: Enables / Disables the multicast packet management mechanism
 - When your system uses broadcast packet transmission, it is easy to form a network storm in the wireless transmission system or cause the CPU load is too large, causing the device to crash; start IGMP can solve such broadcast packet transmission and network storm problem.

Special instructions: EL-N series if set to AP mode operation, APM-100 series of wireless devices need to setting as station mode, and must go to 「Advance Setup」 to start the "CPE" mode of operation, and then the EL-N AP operation mode can link APM-100 series link OK.

◆ AP mode - Radio setting:

Radio 2

Radio	AP
SSID ID	WLAN_2
Security	<input type="checkbox"/> secretkey
Parameters	40 MHz
Tx Power Level	Maximum
Frequency(MHz)	5G:CH100 5500 MHz
Distance(km)	1
Client Isolation	Non Isolated - EL Stations
Allow Connection	All Clients

- Radio card (wireless module): have MESH or AP or STA mode, please select AP mode.
 - OFF: Turn off the wireless interface operation, when the wireless card module is not used, it is recommended to close the card interface, in addition to reducing power consumption, can also reduce the risk of wireless interference.
 - AP: Set to AP base station (server / receiver)
 - STA mode: Set to STA-Station platform side (client / transmitter)
 - MESH: Set to multi-path backup wireless transmission function
- SSID ID setting: set the wireless card SSID (wireless AP name)
- Security encryption: default password 12345678; check Enable / Uncheck to close the encryption; check can be secretkey as a secure encryption password or enter the encryption password settings, for example: 991neciopower.
- Parameters: Set radio frequency parameters, including 10MHz / 20MHz / 40MHz wireless band use width, 2x2 MIMO / 1x1 SISO antenna system, 400ns / 800ns GI interval (The distance between the two ends of the selected radio frequency width 10MHz / 20MHz / 40MHz must be consistent, otherwise can not connect.)
- Output power level: Wireless transmit power level (Every 3dBm will upgrade one times)
 - Transmission power size level is divided into:

Maximum – Max	Half-1/2	Quarter-1/4
Eighth-1/8	Sixteenth-1/16	Minimum-Min

- Use frequency: The use of direct input frequency mode settings, if the input frequency is wrong, the system will automatically select the closest frequency to use. You can also refer to the frequency range display frequency area.
- Distance parameter (Km): 1Km for the distance between the parameter units (1Km within the default value of 0)
- Client isolation: "All Isolated", "EL series is not isolated (default)", "all is not isolated."
If the AP mode of operation is the surf Internet service that provides the public environment, it is recommended to start the "all isolation" setting.
- Client connection: "Allow all client connections (default)", "Allow only EL series connection".
If the AP operation mode is intended for wireless backbone transmission, it is recommended to start "only EL series connection".

■ STA (Station Client) mode setting

The STA mode setting includes Global, Network, and Radio.

◆ STA mode - Global settings:

Global	
Device Info	<input type="text" value="device info"/>
Longitude(-180.000000 ~ 180.000000)	<input type="text" value="0"/>
Latitude(-90.000000 ~ 90.000000)	<input type="text" value="0"/>

- Device information: by the erection system users to enter their own to identify the set of wireless devices.
- Longitude: Setting Longitude
- Latitude: Setting Latitude

◆ STA mode - Network settings:

Network	
IP address	<input type="text" value="192.168.1.11"/>
Netmask	<input type="text" value="255.255.255.0"/>
Default Gateway	<input type="text" value="0.0.0.0"/>
Management VLAN ID	<input type="text" value="0"/>
IGMP Snooping	<input type="text" value="Enable"/> <input type="checkbox"/>

- IP address: Device Ethernet IP address.
- Network segment cover Netmask: default is 0.0.0.0.
- Preset gateway: gateway address.
- Manage VLAN ID: Set the management VLAN ID.
- IGMP Snooping: Enables / Disables the multicast packet management mechanism
 - When your system uses broadcast packet transmission, it is easy to form a network storm in the wireless transmission system or cause the CPU load is too large, causing the device to crash; start IGMP can solve such broadcast packet transmission and network storm problem.

Special Note 1: If the EL-N series is configured for STA-Station client mode, it is not possible to connect to the AP operation mode of the APM-100 series wireless device.

Special Note 2: If the EL-N series is configured for STA-Station client mode, it can be connected to the AP operation mode of the general market wireless device.

◆ STA mode - Radio setting:

...
Radio 2

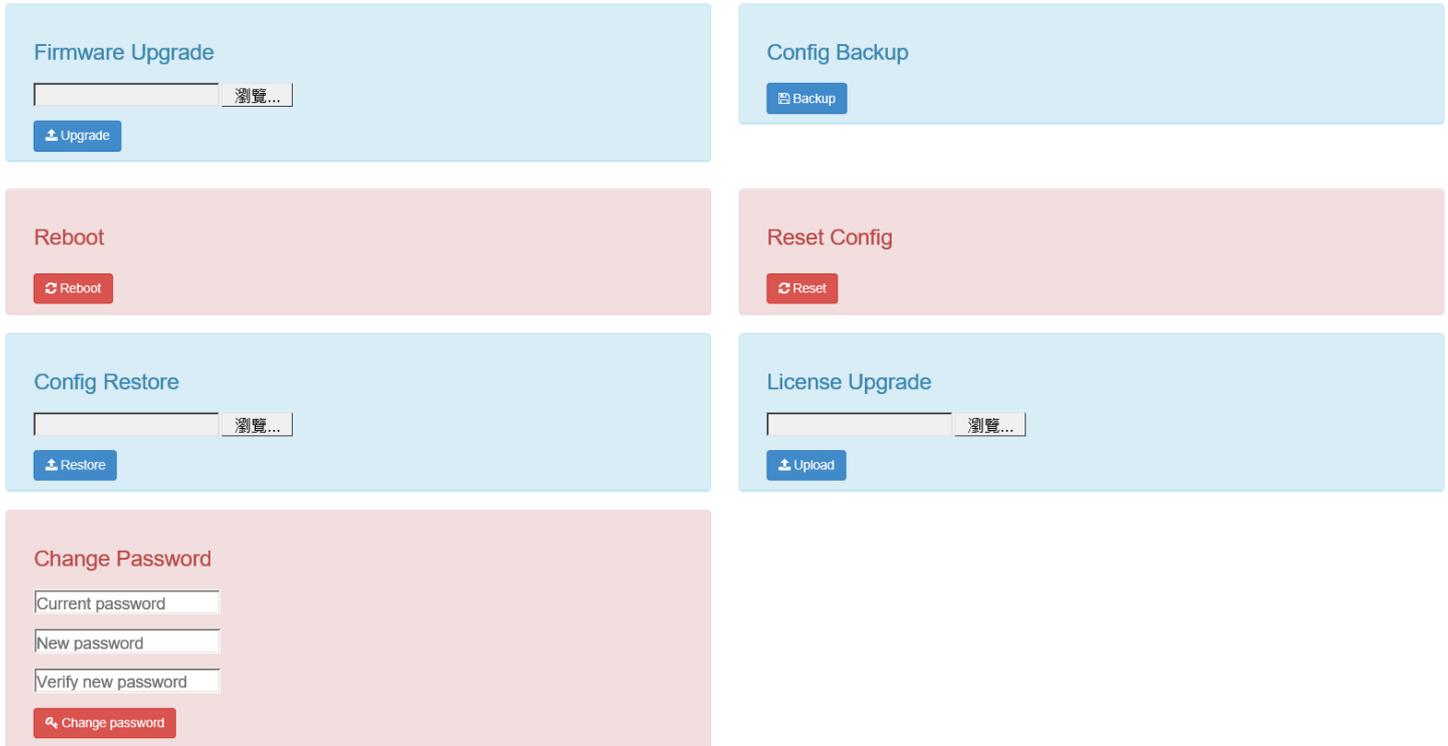
Radio	STA
SSID ID	WLAN_2
Security	<input type="checkbox"/> secretkey
Parameters	40 MHz
Tx Power Level	Maximum
Frequency(MHz)	5G:CH100 5500 MHz
Distance(km)	1

- Radio card (wireless module): have MESH or AP or STA mode, please select STA mode.
 - OFF: Turn off the wireless interface operation, when the wireless card module is not used, it is recommended to close the card interface, in addition to reducing power consumption, can also reduce the risk of wireless interference.
 - AP: Set to AP base station (server / receiver)
 - STA mode: Set to STA-Station platform side (client / transmitter)
 - MESH: Set to multi-path backup wireless transmission function
- SSID ID setting: set the plan to link wireless AP's SSID (wireless AP name)
- Security encryption: default password 12345678; check Enable / Uncheck to close the encryption; check can be secretkey as a secure encryption password or enter the encryption password settings, for example: 991neciopower.
- Parameters: Set radio frequency parameters, including 10MHz / 20MHz / 40MHz wireless band use width, 2x2 MIMO / 1x1 SISO antenna system, 400ns / 800ns GI interval (The distance between the two ends of the selected radio frequency width 10MHz / 20MHz / 40MHz must be consistent, otherwise can not connect.)
- Output power level: Wireless transmit power level (Every 3dBm will upgrade one times)
 - Transmission power size level is divided into:

Maximum – Max	Half-1/2	Quarter-1/4
Eighth-1/8	Sixteenth-1/16	Minimum-Min
- Use frequency: The use of direct input frequency mode settings, if the input frequency is wrong, the system will automatically select the closest frequency to use. You can also refer to the frequency range display frequency area.
- Distance parameter (Km): 1Km for the distance between the parameter units (1Km within the default value of 0)

9. Manager Items

■ Device Management Items



The screenshot displays a web interface for device management with the following sections:

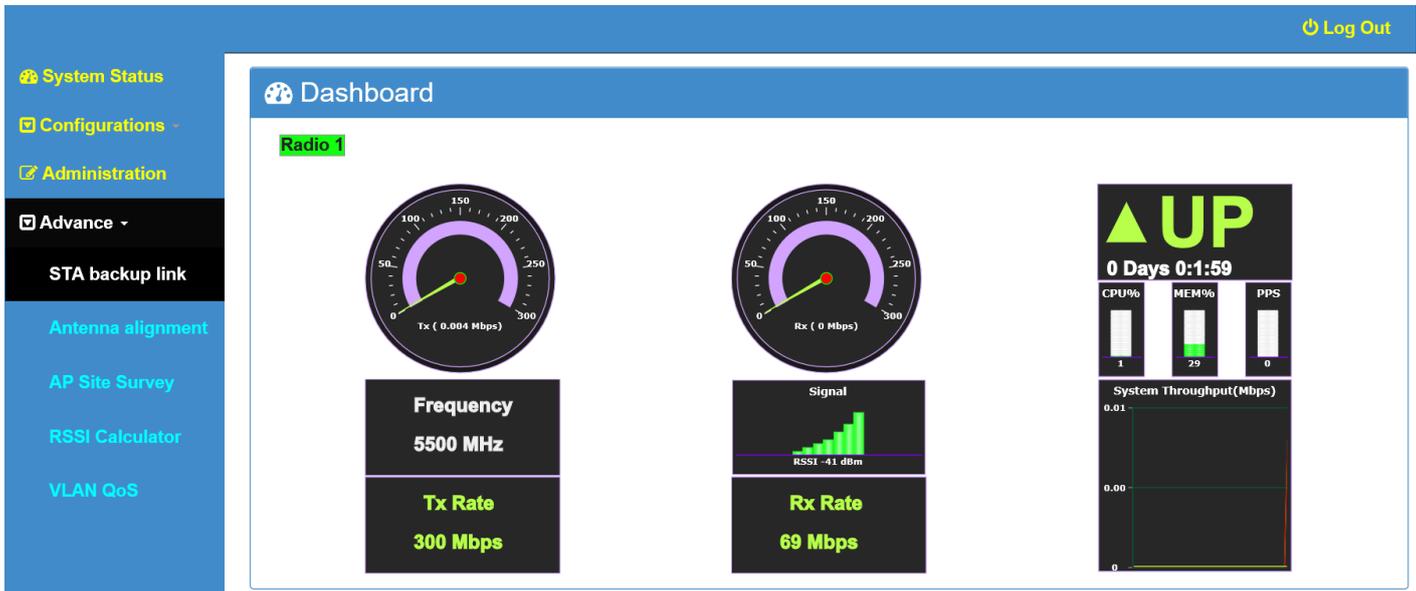
- Firmware Upgrade:** Includes a file selection input field with a "瀏覽..." (Browse) button and an "Upgrade" button.
- Config Backup:** Includes a "Backup" button.
- Reboot:** Includes a "Reboot" button.
- Reset Config:** Includes a "Reset" button.
- Config Restore:** Includes a file selection input field with a "瀏覽..." (Browse) button and a "Restore" button.
- License Upgrade:** Includes a file selection input field with a "瀏覽..." (Browse) button and an "Upload" button.
- Change Password:** Includes three input fields for "Current password", "New password", and "Verify new password", along with a "Change password" button.

- ◆ Firmware update: Update the Firmware, select the firmware file to update, press the update button, the system will start the "update download time" and "update the required time to complete the countdown."
- ◆ Config backup: backup wireless device configuration settings and parameters of the information, backup into a backup file, the device failure or equipment replacement, the direct reduction of equipment settings and parameters.
- ◆ Reboot: press the reboot button, the device to restart, reboot time about 50 seconds to complete.
- ◆ Reset config: press the reset config button, the device to restore the factory value, before the relevant settings and parameters will be cleared.
- ◆ Config Restore: Select the backup file of the previous device. After pressing the Config Restore button, the system will start the "Backup File Download Timing" and "Restore Countdown".
- ◆ License upgrade: update the copyright of the device or upgrade to ML-N MESH Hi-mobile product copyright.
- ◆ Changed Password: Change the password for device login.

Note: When you change the items, the system may automatically restart, please wait for the system to restart, then re-login operation.

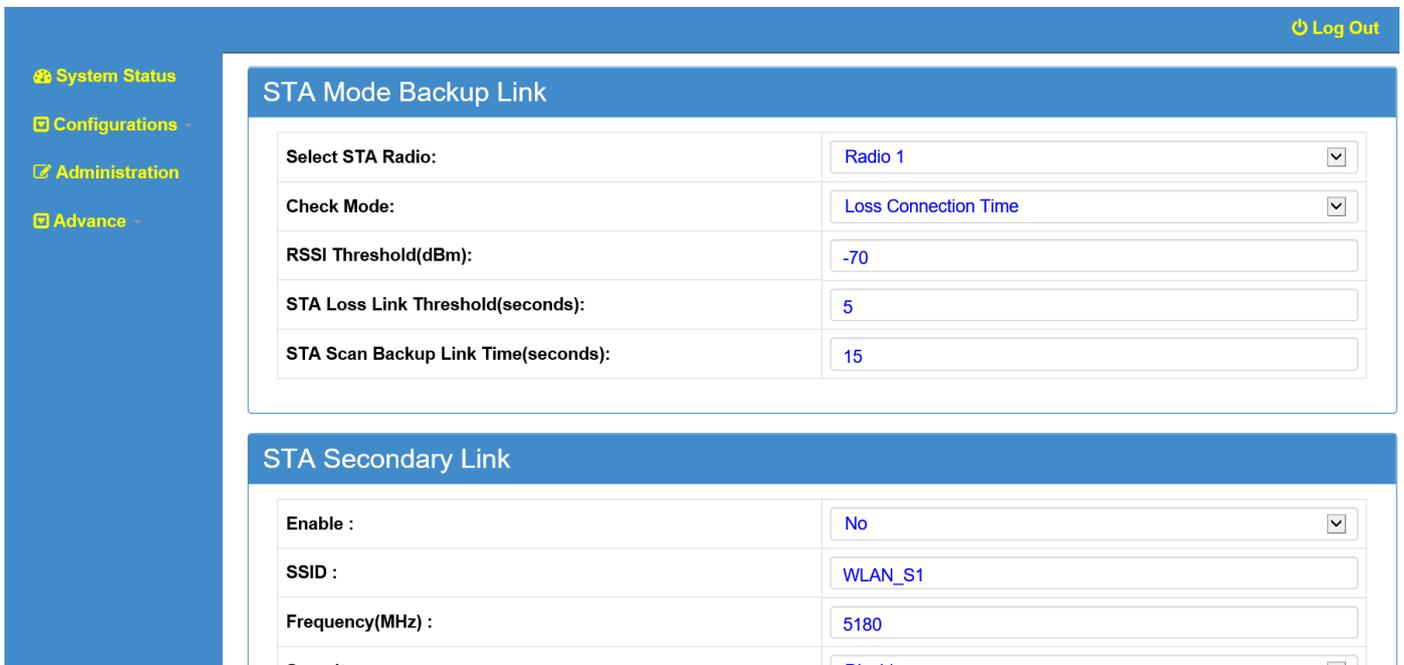
10. Advanced

Advanced settings: including STA backup settings, antenna tuning tools, AP channel scanning, RSSI calculator and VLAN QoS settings



■ STA backup setting:

(This function can be enabled when the wireless device is set to operate in STA mode)



The configuration page includes the following settings:

- STA Mode Backup Link:**
 - Select STA Radio: Radio 1
 - Check Mode: Loss Connection Time
 - RSSI Threshold(dBm): -70
 - STA Loss Link Threshold(seconds): 5
 - STA Scan Backup Link Time(seconds): 15
- STA Secondary Link:**
 - Enable: No
 - SSID: WLAN_S1
 - Frequency(MHz): 5180
 - Security: Disable

The STA backup setting includes:
 STA mode backup link setting
 STA second backup
 STA third backup
 And STA fourth backup.

◆ STA mode backup link setting

Log Out

System Status

Configurations

Administration

Advance

STA Mode Backup Link

Select STA Radio:	Radio 1
Check Mode:	Loss Connection Time Detect RSSI Threshold
RSSI Threshold(dBm):	-70
STA Loss Link Threshold(seconds):	5
STA Scan Backup Link Time(seconds):	15

- STA RF: Select the RF number you set as the STA. The drop-down options are RF 1 / RF 2 / RF 3.
- Detection method: You can choose the connection disconnection time or the receiving signal "RSSI critical point" as the basis for the detection and backup connection.
 - The minimum disconnection time is set to 3 seconds.
 - RSSI critical point needs to be set between -20 ~ -90 (dBm)
- RSSI critical point (dBm): It is recommended to set between -58 (dBm) ~ -70 (dBm).
- STA disconnection time (seconds): It is recommended to set between 3 ~ 5 (seconds).
- STA scan backup line time (seconds): When the above detection mode conditions have been met, the software will start to find the second backup of the STA. After the STA scan backup line has completed the set time, if it is not completed. The backup connection will start again to find the STA's third backup, and will also perform the set scan backup time, and so on. It is recommended to set between 10 (seconds) and 15 (seconds). The STA scan backup line time (seconds) is set to a minimum of 10 seconds.

◆ STA second backup / STA third backup / STA fourth backup setting:

STA Secondary Link

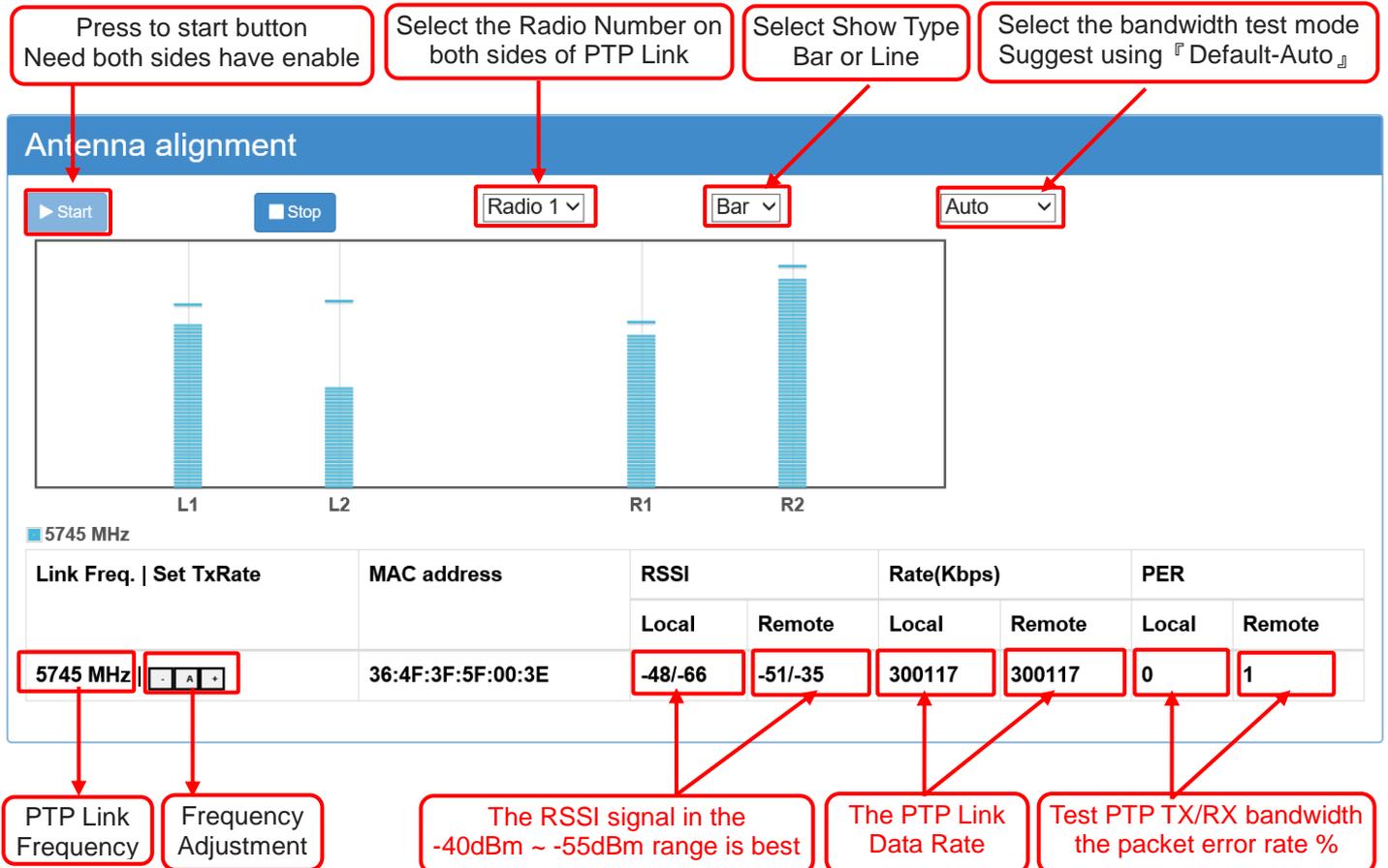
Enable :	No Yes
SSID :	WLAN_S1
Frequency(MHz) :	5180
Security :	Disable
Security Key :	secretkey

- Enable: Select to enable STA second backup (or STA third backup or STA fourth backup).
- SSID: The user performs SSID setting of STA second backup or STA third backup or STA fourth backup according to the SSID of other wireless APs set up on the site.
 - It is recommended to plan the SSID wireless signal coverage architecture of the four APs as much as possible for the entire wireless system. For the wide-range or different areas of the wireless signal coverage field, the distance-signal attenuation covered by the antenna can be used to reuse the same four APs. The SSID wireless signal coverage can achieve the effect of automatic backup connection in a large-scale case or in different regional cases.
- Frequency (MHz): Users can pre-plan and set different wireless AP frequencies, so that the AP's wireless signal coverage interference is reduced, and STA second backup (or STA third backup or STA fourth backup), according to the setting. The frequency is scanned for software features.
- Encryption: Select to enable or disable encryption. Wireless encryption will increase the switching time of STA backup connection by 1~2 seconds. Please pay special attention.
- Password: The user fills in the STA second backup (or STA third backup or STA fourth backup) according to the password set by different APs.

Wireless installation antenna alignment tool:

Special reminder:

1. The wireless installation antenna alignment tool is used in the PTP MESH mode. In addition to signal tuning for antenna alignment, it can also perform transmission bandwidth calculation and packet loss rate judgment.
2. The wireless installation antenna alignment tool is used in the AP and STA modes. It can only be used for signal conditioning of the antenna alignment. It is impossible to judge the operation of the transmission bandwidth and the packet loss rate.



Press to start button
Need both sides have enable

Select the Radio Number on both sides of PTP Link

Select Show Type Bar or Line

Select the bandwidth test mode Suggest using 『Default-Auto』

Antenna alignment

▶ Start ■ Stop Radio 1 Bar Auto

L1 L2 R1 R2

5745 MHz

Link Freq. Set TxRate	MAC address	RSSI		Rate(Kbps)		PER	
		Local	Remote	Local	Remote	Local	Remote
5745 MHz [A]	36:4F:3F:5F:00:3E	-48/-66	-51/-35	300117	300117	0	1

PTP Link Frequency Frequency Adjustment

The RSSI signal in the -40dBm ~ -55dBm range is best

The PTP Link Data Rate

Test PTP TX/RX bandwidth the packet error rate %

- ◆ PTP Mesh The device presses the "Start button" and the device will display the above antenna adjustment data.
- ◆ Select the radio frequency card number that you have connected and want to adjust the antenna
- ◆ Select "Bar" blue bar: the wireless connection signal status, the higher the better the signal; the highest point for the last 60 seconds of the best signal position or select "Line" linear fluctuations in the display mode.
- ◆ PTP Mesh wireless devices on both sides need to open the antenna adjustment page, and press the "start button", will appear above the antenna adjustment data.
- ◆ Below the current two sides of the PTP Mesh connection using the frequency (5745MHz), the right direction of the direction arrow button, is to lift the transfer rate of the operation, press the

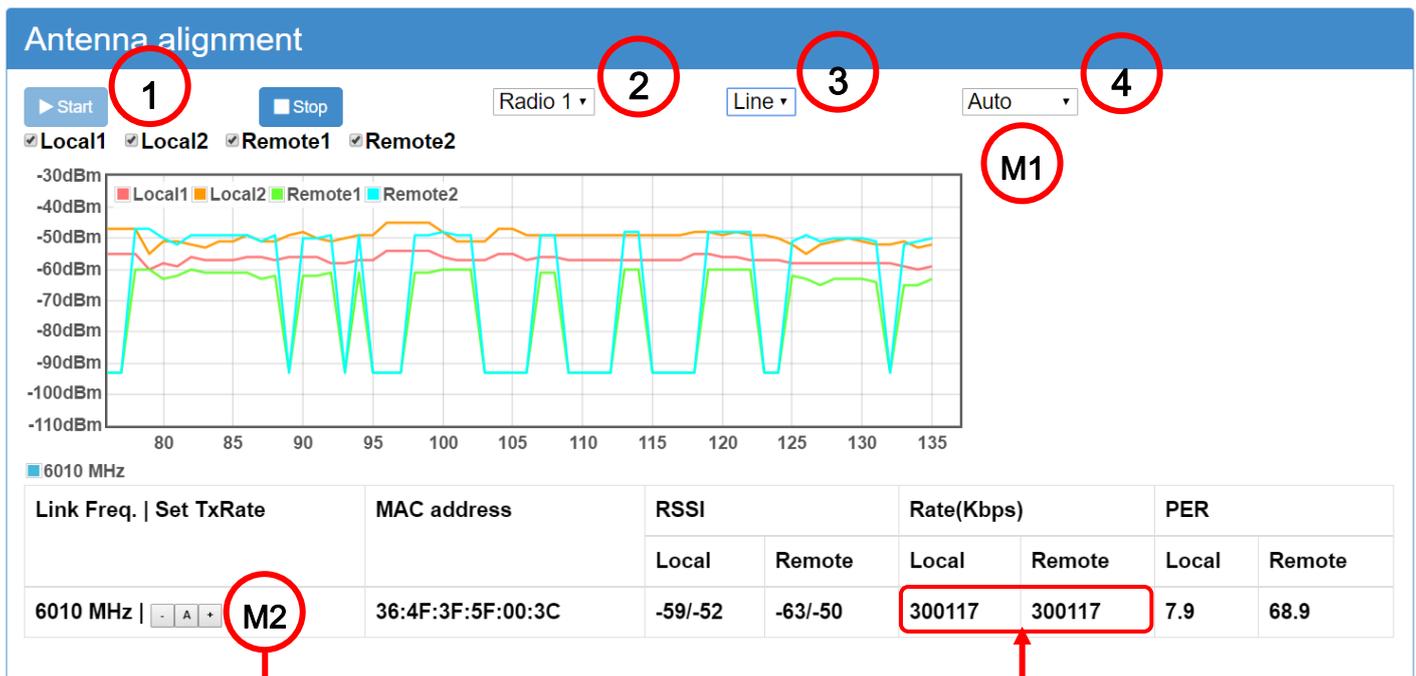
"A" button to test the automatic transfer rate , Press "+" or "-" on behalf of the user in the test, according to their own swap rate to increase the wireless transmission rate, in order to obtain the minimum swap rate and the best transmission bandwidth.

- ◆ Antenna alignment tool adjustment, mainly to determine the following three characteristics:
 - RSSI received signal strength: the best range of receiving signal -40 ~ -55dBm, followed by -56 ~ -65dBm, the last -66dBm ~ -75dBm, -76dBm ~ above the signal instability and disconnection.

Signal strength is only a reference value, not an absolute value, if the wireless signal noise ratio or clarity or density ratio problems such as, will produce high signal strength, low transmission rate or low bandwidth flow phenomenon
 - Transmission data rate (Kbps): According to the different transmission channel width mode, there will be 802.11a-54Mbps, 802.11an HT20MHz-170 / 180Mbps, 802.11an HT40MHz-270 / 300Mbps, etc., the highest transmission rate.

The transmission rate is only the reference value, not the absolute value, if the wireless transmission packet collision or packet delay or packet loss rate or signal interference cover and other factors, will have a high transmission rate, low transmission bandwidth or transmission bandwidth the traffic shock is very large or the transmission rate rises or falls and the change is unstable.
 - Packet error rate (%): wireless packet error rate occurs with the following reasons
 - Wireless signal reception strength is insufficient, resulting in transmission rate instability, causing the transmission rate changes, and ultimately leads to dropped packets rate.
 - Wireless signal noise is too high or clarity is too low or uneven density, resulting in instability in transmission rate, dropped packets increased.
 - The packet collision of the wireless transmission link causes the number of packets to be transmitted successfully to be reduced (the total number of packets is not changed).
 - Wireless transmission of the packet response delay (ACK Time / Delay), resulting in the number of packets determined to be successful transmission significantly reduced (the total number of transmission packets is not changed).
 - Wireless transmission rate can not reach the user (tester) forced set the transmission bandwidth (transmission rate and bandwidth requirements asymmetry), resulting in the number of packets determined to be successful transmission significantly reduced.

Antenna calibration test instructions



M2 Adjusts the unilateral transfer rate and displays the change in the data rate

- ◆ 1. Press the "Start button"
- ◆ 2. Select "Radio network cards number that have been connected to each other"
- ◆ 3. Select "Test message mode"
- ◆ 4. Select the "transmission bandwidth to be tested"
 - Defaults run Auto - automatically tested by the system automatically with 50% of the "current transmission rate" and 50% of the "current received rate", so the total bandwidth will have 100%. (Recommended to use Auto, so that the system to optimize the adjustment tests.)
- ◆ 5. Go to the "remote wireless device", the same sequence of operations in the above; when both ends of the antenna calibration test settings are completed, the system will automatically start after 10 seconds Auto preset 75Mbps transmission +75 Mbps receive, it is total of about 150Mbps bandwidth flow test, and the "packet error rate (%)" test results, shown in the screen.
- ◆ In response to the system automatically adjust the "packet error rate (%)" with Auto about 150Mbps bandwidth flow test, if the result of "packet error rate" exceeding 2% is displayed (the display% will always be bounced to stabilize the packet for a long time Rate of the main), on behalf of both ends of the point-to-point transmission to achieve a stable 150Mbps bandwidth traffic, the need for "antenna alignment" or "set the transmission rate" or "channel frequency" or "bandwidth traffic reduction" and other adjustments.
- ◆ Through the M1 manual set to test the bandwidth flow (two-way total) of the lift or down, you can immediately see the "packet error rate" changes, down to the packet error rate stable at

0%, can confirm the transmission bandwidth can be achieved How much throughput; special reminder: bandwidth flow adjustment on both sides have to be adjusted, if the unilateral adjustment is only unilateral adjustment movements.

◆ Through M2: A automatically adjust the transmission rate by the system; automatically adjust the transmission rate of the results will be displayed in the local / remote side of the transmission rate display area.

◆ Adjust the transfer rate manually by setting M2: - & + manually. The result of manual adjustment of transmission rate will be displayed in the transmission rate display area of the local / remote terminal.

Special reminder: transfer rate adjustment both sides must be adjusted at the same time, if the unilateral adjustment only one side of the adjustment movements.

◆ M1 test bandwidth Description:

➤ Bilateral automatic bandwidth test: the system based on the "current transmission rate" of 50% transmission and 50% received a total of 100% of the bandwidth flow for automatic testing.

To 300Mbps data rate definition, the system will be about 75Mbps transmission + about 75Mbps receive a total of about 150Mbps bandwidth flow test.

➤ Manually set the bandwidth test: manually set the 1Mbps ~ 200Mbps bandwidth flow test to see the swap rate error 0% when the stable transmission bandwidth value; the maximum can be set on both sides 100Mbps transmission bandwidth, about 100Mbps transmission + 100Mbps receive, a total of about 200Mbps bandwidth flow test.

➤ Manually set the one-way bandwidth test: manually set the side of the test bandwidth is 1Mbps, the other side of the test bandwidth of 200Mbps, so set will produce a side of 1Mbps, the other side of the transmission 200Mbps, and you can get one side of the one-way Bandwidth flow of 200Mbps test results.

➤ If the test bandwidth on both sides of the test is 200Mbps, on behalf of the test total bandwidth flow of 400Mbps, has exceeded the wireless device transmission bandwidth specifications, "packet error rate (%)" will increase significantly; The test bandwidth on both sides of the flow are reduced to about 100Mbps.

◆ After adjusting the antenna to the best condition of the bilateral signal, you can stop the adjustment function.

■ STA / AP Site Survey Tool:

Space environment with MESH and STA / AP mode Wireless signal scanning

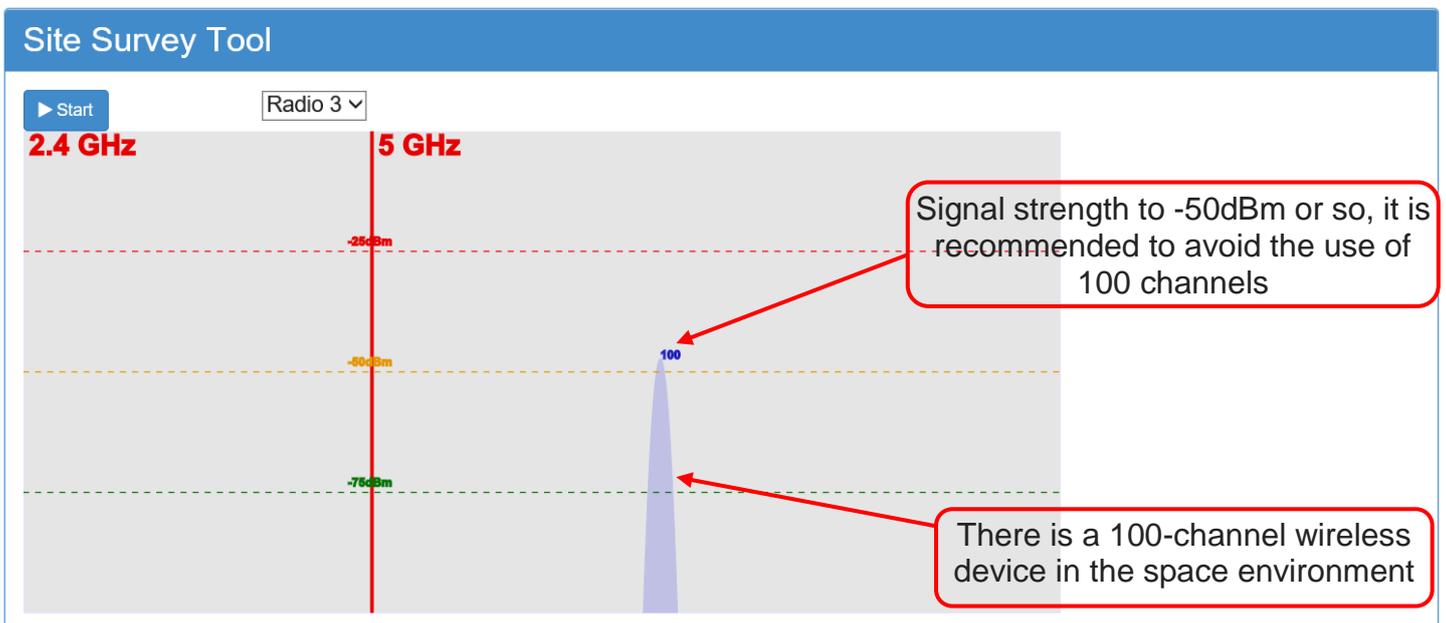


◆ MESH / STA / AP mode space environment wireless signal scanning

- Press the "Start" button, the device will start the last 15 seconds of the space environment Wireless signal scanning operations

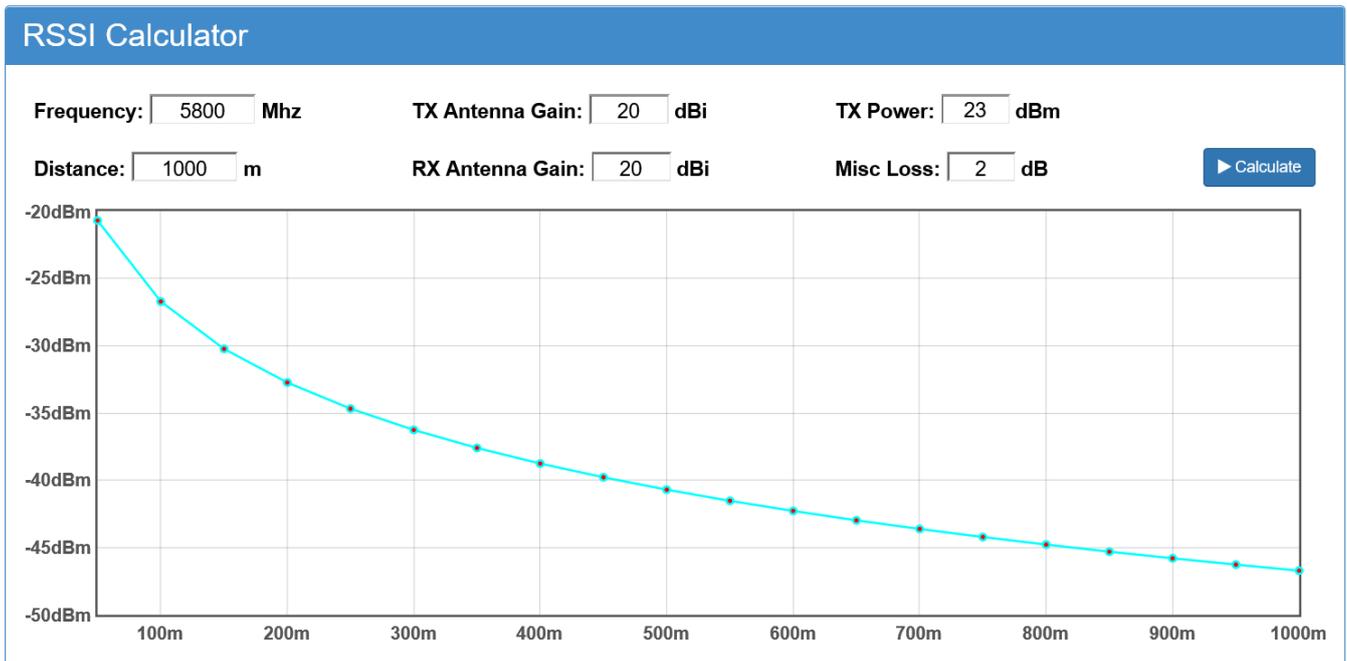


- Scan results will be displayed in the screen, divided into 2.4GHz and 5GHz two radio frequency, green -75dBm the following RSSI, on behalf of the wireless interference intensity is low, little chance of interference; orange -50dBm following RSSI, on behalf of wireless interference High strength, the occurrence of interference opportunities, set up wireless devices should avoid using the same channel; red -25dBm the following RSSI, on behalf of the strong intensity of wireless interference, the inevitable occurrence of wireless signal interference, you must avoid using the wireless channel.



RSSI Calculator

(Pre-estimated for point-to-point wireless signal reception strength)



- ◆ Frequency: Enter the wireless connection frequency you expect to use. If you are not sure which radio frequency you want to use, it is recommended to use the default 5800MHz.
- ◆ Distance: input transmitter and receiver both ends of the straight line distance, both ends of the wireless transmission path can not have obstacles
 - If there are other high-rise buildings or trees or mountain at both ends of the straight-line distance, the interference factor of the Fresnel Zone should be considered.
 - If the straight line distance of more than 7 km, need to consider the Earth Bulge Effects (1/8 curve rate) factor.
- ◆ TX Antenna gain: Enter the antenna gain you expect to use at the transmitter. If the last calculated RSSI is below -65dBm, for example: Calculate the result RSSI = -72dBm, it is recommended to replace the higher gain antenna.
- ◆ RX Antenna Gain: Enter the Antenna gain you expect to use at the receiving end. If the last calculated RSSI is below -65dBm, for example: Calculate the result RSSI = -72dBm, it is recommended to replace the higher gain antenna.
- ◆ TX Power: Enter the output power of the radio frequency card module, usually in the product specifications of the maximum output power; if you require more accurate RSSI calculation, you need to use the radio frequency mode and transmission rate requirements. The corresponding output powers prevail. EL-N or ML-N series with 20 ~ 25dBm for the output power definition.
- ◆ Other Misc Loss: the default value of 2dB; other Misc Loss mainly based on the following several considerations.

- Cable loss (antenna extension cable and connector caused by wireless signal attenuation): Recommended 0.25 to 0.5dB per meter attenuation estimates.
- Rain attenuation (rain caused by wireless signal attenuation): recommended within 20 km to 2 ~ 3dB attenuation estimates can be.
- Tree failure (trees caused by wireless signal attenuation): In principle, the thickness of the leaves to 15 to 20dB per meter attenuation estimates.
- Air vapor density or impurity attenuation: the proposed 20 km or less, to 1 ~ 2dB attenuation estimation can be.

◆ Press the "Calculate" button, the RSSI calculator will automatically calculate and calculate the results in 20 grid allocation.

Suggested RSSI calculation results should be between -40dBm ~ -60dBm interval is the best, more than -70dBm above the need to put a higher gain antenna, in order to obtain better signal strength and more stable transmission.

■ VLAN QoS function settings:

Provides 15 VLAN tags corresponding to four QoS priorities

VLAN QoS		
VLAN QoS:	Disable	
#	VLAN Id	Queue Priority
1	0	BE(default)
2	0	BE(default)
3	0	BE(default)
4	0	BE(default)
5	0	BE(default)
6	0	BE(default)
7	0	BE(default)
8	0	BE(default)
9	0	BE(default)
10	0	BE(default)
11	0	BE(default)
12	0	BE(default)
13	0	BE(default)
14	0	BE(default)
15	0	BE(default)

- Enable / disable the VLAN QoS mapping mechanism
 - VLAN ID: 1 ~ 4095
 - Queue Priority:
 - 0: BE (default) 1: BK (lowest)
 - 2: VI (high) 3: VO (highest)
- The radio transmission priority order is VO (3)> VI (2)> BE (0)> BK (1)

11. Product Specifications Table

■ Hardware Specification

Key Components	
Main Processor	Atheros AR7161 (680Mhz)
Wireless Chipset	<ol style="list-style-type: none"> Standard with: Atheros AR9220 mini PCI,IEEE 802.11 a/n,2T2R MIMO, 300Mbps Optional with: Atheros AR9220 mini PCI,IEEE 802.11 a/g/n,2T2R MIMO, 300Mbps
Switch Controller	Atheros AR8035
Flash Memory	16MBytes
SDRAM	128MBytes
Interfaces Specifications	
Wireless RF Module	<ol style="list-style-type: none"> Standard with:RFS5-M22M Atheros AR9220 mini PCI, Output Power 25dBm Max, IEEE 802.11 a/n, 2T2R MIMO, 300Mbps. Optional with:DNMA-H92 Atheros AR9220 mini PCI, Output Power 23dBm Max, IEEE 802.11 a/g/n, 2T2R MIMO, 300Mbps. Product Model Number and built in Wireless RF module: EL-N-1: 1 Wireless RF Module EL-N-2: 2 Wireless RF Modules EL-N-3: 3 Wireless RF Modules
Wireless Frequency	<ol style="list-style-type: none"> Standard with:RFS5-M22M IEEE 802.11 a/n,5.8GHz (4.9~6GHz). Optional with:DNMA-H92 2.4GHz / 5.8GHz 2.3~2.7/4.9~6.1GHz).
Frequency Bandwidth	10MHz / 20MHz / 40 MHz
Wireless Module Interface	EL-N-1: 2 x N-type Female Connectors EL-N-2: 4 x N-type Female Connectors EL-N-3: 6 x N-type Female Connectors
Ethernet Interface	<ol style="list-style-type: none"> Group 1 wired network port: Support 10/100/1000Mbps RJ-45 port, Compatible with:IEEE802.3/802.3i/802.3u;and support 802.3af/3at Passive PoE PD mode Group 2 wired network port: Support 10/100/1000Mbps RJ-45 port, Compatible with: IEEE802.3/802.3i/802.3u (Optional) Ethernet Network Port:Support10/100/1000Mbps , based on 10BASE-T,100BASE-T,1000BASE-T and Half-duplex / Full-duplex / Half & Full-duplex and support Auto negotiation
I/O Interface	RS-232 (PCBA onboard)
Ethernet Surge Protect Interface	Interface : Ethernet RJ-45 Female Port Supports Ethernet lightning surge protection up to 10KA



Standard with:RFS5-M22M IEEE 802.11 a/n, 2T2R MIMO, Data Rate 300Mbps

IEEE 802.11a

802.11a RF Module 5150 ~ 5745MHz 5805 ~ 5825MHz Data Rate Output Power Rx Sensitivity	Data Rate	Output Power	Rx Sensitivity
	6Mbps	25dBm	-95dBm
	9Mbps	25dBm	-95dBm
	12Mbps	25dBm	-94dBm
	18Mbps	25dBm	-91dBm
	24Mbps	25dBm	-88dBm
	36Mbps	24dBm	-85dBm
	48Mbps	23dBm	-81dBm
	54Mbps	23dBm	-79dBm

Index MCS	IEEE 802.11an /HT20				IEEE 802.11an /HT40			
	Data Rate (Mbps)		Output Power dBm	Rx Sensitivity	Data Rate (Mbps)		Output Power dBm	Rx Sensitivity
	GI=800ns	GI=400ns			GI=800ns	GI=400ns		
MCS8	13	14.4	25	-94 dBm	27	30	25	-90 dBm
MCS9	26	28.9	25	-92 dBm	54	60	25	-89 dBm
MCS10	39	43.3	25	-90 dBm	81	90	25	-87 dBm
MCS11	52	57.8	24	-87 dBm	108	120	24	-83 dBm
MCS12	78	86.7	23	-84 dBm	162	180	23	-80 dBm
MCS13	104	115.6	23	-80 dBm	216	240	23	-77 dBm
MCS14	117	130.3	23	-78 dBm	242	270	23	-75 dBm
MCS15	130	144.4	23	-76 dBm	270	300	23	-73 dBm

Note: Output Power +- 1.5dBm



Power Requirement

Power Supply	<ol style="list-style-type: none"> Support AC100~260V 1.2~2.0A 50/60Hz adapter, output 12~28Vdc 4.0A above With IEEE 802.3af/3at Passive mode PoE-PSE , output 48Vdc 1.5A 72W Max With the product has AC 100 ~ 240V / 1.2A ~ 2.0A to DC DC 19V / 4.7A adapter
Power over Ethernet PD	Support IEEE 802.3af/3at Passive mode PoE PD 48Vdc 1A max
PCBA power-receiving terminal (optional)	Support DC Jack 2.1mm receiving connector, power supply required 12Vdc 4A (inclusive) or more, through the second waterproof head access to power input connector
Power consumption of equipment (including PoE power supply)	<ol style="list-style-type: none"> EL-N-1: 6W/H, 100Mbps Full Speed 8W/H max, Start on 12W max EL-N-2: 8W/H, 200Mbps Full Speed 10W/H max, Start on 16W max EL-N-3: 10W/H, 300Mbps Full Speed 12W/H max, Start on 20W max <p>Use the PoE to power supply, please use the IEEE 802.3at 48Vdc 1A above Passive mode PoE PSE.</p>

Physical Size and Weight

Size	260mm * 250mm * 80mm
Weight	EL-N-1/2/3 weight 1.8Kg / 1.9Kg / 2.0Kg Product packaging (including accessories & PoE Injector) 4.0Kg, Shipping cartons 4 box total is 16Kg

Environmental Tolerable Specifications

Operation temperature	-30 ~ 70°C
Humidity	0% ~ 95% Non-condensing
Storage temperature range	-40~ 85°C
Waterproof and dustproof	Outdoor IP68 rated

Product Certification

Certification	FCC NCC (Taiwan) BSMI (Taiwan)
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Software Specification

Network Switching Software Function	
Network bridging functionality	<ol style="list-style-type: none"> 1. Mesh network data transmission with Data Link Layer interface of OSI (Open System Interconnection Reference Model) Layer 2 data Link & Layer 3 to achieve fast data transfer and automatic healing links to reduce selection path delay And multi-hop relay bandwidth attenuation, to provide more than 100Mbps after 16 hops of bandwidth. 2. PTP Mesh Private enclosed wireless backhaul transmission system technology 3. With PTP Mesh Ring loop disconnection and recovery backup transmission function 4. PTP Mesh Hops with 250 consecutive wireless hops relay platform of low loss bandwidth and low latency response technology. 5. Fast Transparent Forwarding. 6. Support IGMP Snooping for Internet Group Management Protocol. (IGMP V2 & IGMP V3) 7. Support Management VLAN and Data VLAN 15 Group QoS. (WMM)
Wireless Device Operation	
System operation mode	Support AP / STA (Station) / PTP Mesh (PTP / PTP Mesh Hops / PTP Mesh Ring / Multi PTP Mesh Ring) operation modes
Wireless operation multi-mode and multi transmission interface operation	Support wireless operation multi-mode and wireless multi transmission interface, according to operational needs set to switch to AP or PTP Mesh mode of operation and cope with multi-link relay platform and pooled data transmission and surf Internet service and other system needs.
Supports wireless IGMP communication protocol	IGMP Snooping protocol to solve the transmission requirements of multiple is monitoring and management units at the same time to capture a large number of video broadcast packets, and improve the efficiency of IP multimedia streaming.
PTP Mesh Ring wireless multi-loop automatic redundancy	<ol style="list-style-type: none"> 1. PTP Mesh Ring with the backhaul of the hops to automatically detect the disconnect circuit or increase the set Cost to specify the function of disconnecting the loop point 2. PTP Mesh Ring is equipped with the backbone of the hops platform to automatically detect and repair the redundant connection 3. With Multi PTP Mesh Ring multi-group loop disconnection and automatically detect repair backup connection function 4. Support across wireless and wired different networks to run PTP Mesh Ring auto-detecting and repairing redundant connection function 5. Support automatic find the best transmission path 6. Support automatic multi-outlet network shunt balance function 7. With automatic update system node message function



<p>PTP Mesh Hops multi-loop continuous relay platform function</p>	<ol style="list-style-type: none"> 1. PTP Mesh Hops Low-loss bandwidth technology for 250 times hops stations 2. PTP Mesh Hops increases the delay time by 1ms for each hop, and increases by 1ms every third or four hops. 3. PTP Mesh Hops relay platform transmission bandwidth TCP packet: Hop 8 times up to 150Mbps bandwidth Hop 12 times up to 120Mbps bandwidth Hop 16 times up to 100Mbps bandwidth UDP / Broadcast / Multicast packets: Hop 10 times up to 200Mbps bandwidth
<p>Support wireless parameter adjustment function</p>	<ol style="list-style-type: none"> 1. Support channel / transmission power / data rate (ML-N series) / maximum distance parameter adjustment settings, in order to improve the stability of the transmission link. 2. Support advanced wireless parameter setting, optimize the wireless transmission signal quality and transmission stability, including PTP Mesh Ring loop architecture Cost parameter settings and antenna tuning when the radio frequency optimization.
<p>Support wireless environment detection and scanning function</p>	<p>Support wireless environment detection and scanning function, it can help user to set up the wireless frequency evaluation. (AP mode can scan all frequencies, PTP Mesh mode only sweep the set frequency of the upper and lower 20MHz +20 MHz range)</p>
<p>Transmission efficiency and PTP Mesh hops bandwidth</p>	
<p>From the wireless interface transmit to the wired interface (TCP / RTP)</p>	<ol style="list-style-type: none"> 1. One wireless RF module interface, from wireless interface transmit to wired interface the transmission bandwidth up to 180Mbps / 220Mbps max 2. Two wireless RF module interface, from wireless interface transmit to wired interface the total transmission bandwidth up to 300Mbps / 320Mbps max 3. Three wireless RF module interface, from wireless interface transmit to wired interface the total transmission bandwidth up to 320Mbps / 330Mbps max <p>(This information can help you to determine the backhaul transmission bandwidth max)</p>
<p>PPS Number of short packet transmissions</p>	<ol style="list-style-type: none"> 1. One wireless RF module interface can send short packets > 20,000 or more 2. Two wireless RF module interface can send short packets > 28,000 or more 3. Three wireless RF module interface can send short packets > 28,000 or more <p>(In response to multiple devices connected, the Department of the transmission capacity of a number of packets to determine the basis)</p>



PTP Mesh Hops	<p>PTP Mesh hops times of wireless transmission bandwidth: The first hop can support transmission bandwidth is 180Mbps or more The second hop can support transmission bandwidth is 160Mbps or more The third hop can support transmission bandwidth is 155Mbps or more The fourth hop can support transmission bandwidth is 150Mbps or more The fifth hop can support transmission bandwidth is 145Mbps or more</p> <p>PTP Mesh hop10 times after the platform, the transmission bandwidth is still up to 120Mbps or more > = 10 hops response delay <20ms</p> <p>(Encounter buildings or hillside terrain or trees and other obstacles to the situation, can be hop several times relay turn transmission)</p>
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Data Security Encryption and Device Security Management

Data security encryption	<ol style="list-style-type: none"> 1. PTP Mesh network system with a private enclosed wireless transmission system security features. 2. Support wireless group security mechanism having a system group ID (Main Group ID) and a neighboring node connection ID (Link ID) 3. Have the service organization code (SSID) wireless security mechanism. 4. Have WPA / WPA2 PSK / CCMP AES key encryption.
Equipment safety management	<ol style="list-style-type: none"> 1. With the operation interface of the account secret input set security function 2. Firmware software update: dual backup design. 3. The core software authentication encryption, the use of random matrix encryption technology. 4. The mutual authentication mechanism between the device and the central end (in development), and the interoperable devices between different vendors. <p>(PC installs on authentication software or export-side equipment to play-Root, multiple Root, the system can mutual backup).</p>

System management and system maintenance function

System management functions	<ol style="list-style-type: none"> 1. Manage the HTTP (s) WEB GUI through a web browser. 2. Support management VLAN tag. 3. Supports the client side by network time protocol calibration (NTP Client). 4. Supports dual configuration files / Factory Defaults. 5. Support multi-level management Multiple Level Management. 6. Support L2-MAC layer system scanning and automatic detection display and software sub-automatic update of the simple network management.
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<p>System maintenance function</p>	<ol style="list-style-type: none"> 1. Software support Hardware Watchdog. 2. To provide dedicated simple system network management software (under development). 3. Optional SNMPv2c / v3, standard / private MIBs are supported (optional). 4. To provide customized ODM modification, configuration, management. 5. Support firmware files for dual backup. 6. Support firmware upgrade / firmware file rewrite back (downgrade).
<p>System construction erection of auxiliary tools</p>	
<p>Wireless connectivity signal scanning and connectivity auxiliary tools</p>	<ol style="list-style-type: none"> 1. With the wireless set up the environment to detect scanning capabilities to facilitate the wireless engineering and technical personnel to determine the use of channel selection reference 2. Support dynamic wireless signal and transmission rate and flow display icon to facilitate wireless engineering and technical personnel to determine the stability of wireless systems 3. Support the local side and the remote side of the wireless devices, each other to detect the connection signal value and transmission rate and encryption or other information display mechanism to facilitate wireless engineering and technical personnel in the future maintenance, to determine the wireless system at both ends of the signal operation situation
<p>Antenna tuning and transmission bandwidth and packet loss rate testing tools</p>	<ol style="list-style-type: none"> 1. With the antenna set upped, through the built-in software for wireless antenna proofing adjustment mechanism to obtain local and remote far side of the wireless RSSI signal strength information to determine the antenna alignment or not conducive to the construction staff antenna tuning operations 2. Software testing mechanism to support the transmission of wireless links to confirm the transmission bandwidth of wireless systems can exceed 150Mbps or more, and display transmission packet loss rate, in order to determine the connection transmission stability

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Note 1: The IOP-DPOE-OSW1248-4 outdoor 4-port PoE Switch can be used to expand the remote power control through switch PoE ports to control and management the four PoE devices enable or disable. The wireless operation can be performed through the web page of the wireless device operation web UI icon and setting remote power control and switch control by day time schedule.

Note 2: the Advantech Company's EKI-7720G Trunk Switch can be used with the double trunk bandwidth switch to double the EL-N-1's wireless backhaul bandwidth to achieve multi-frequency, multi-channel, low interference and large integrated bandwidth of wireless transmission backhaul solution.



Package Contents

1. IO-Power Outdoor EL-N Series PTP Wireless Mesh Network System (IOP-EL-N-1/2/3 Series)
2. Passive mode PoE-PSE Power over Ethernet Injector (48Vdc 1.5A Max)
3. AC 100 ~ 240V / 1.2A ~ 2.0A to DC 19V / 4.7A adapter
4. AC Code 1.5 meter power cord
5. Rod-type / wall-mounted bracket and U-shaped screws and set screws

If any of the above items are missing, please contact your reseller.

>>>> Select with 2.4GHz & 5.8GHz dual-band Wireless RF module recommendations:

1. Based on wireless surf Internet service need for 2.4GHz WiFi signal coverage of the project application requirements, the proposed dual-band with the choice of wireless RF module.
2. For the frequency of 5GHz is covered by other wireless strong interference or suffer serious wireless signal interference or other special interference, need to replace and use of 2.4GHz frequency of the project application requirements, it is recommended to choose the dual-band wireless RF module.
3. For special transmission application requirements (such as military or hospital area wireless transmission), if necessary, take the choice of dual-band wireless RF module.

Note 1: Choose the high-power dual-band wireless RF card module, will add double power consumption than the high-power single-frequency wireless RF card module.

Note 2: Choice the high-power dual-band wireless RF card module, will add 10°C ~ 15°C the temperature than the high-power single-frequency wireless RF card module.

Optional with: DNMA-H92 IEEE 802.11 a/g/n, 2T2R MIMO, Data Rate 300Mbps

IEEE 802.11g

11g RF 2300 ~ 2700MHz Data Rate Output Power Rx Sensitivity	Data Rate	Output Power	Rx Sensitivity
	6Mbps	25dBm	-95dBm
	9Mbps	25dBm	-95dBm
	12Mbps	24dBm	-94dBm
	18Mbps	24dBm	-93dBm
	24Mbps	23dBm	-89dBm
	36Mbps	23dBm	-86dBm
	48Mbps	22dBm	-82dBm
	54Mbps	22dBm	-81dBm



IEEE 802.11a

11a RF 5150 ~ 5745MHz 5805 ~ 5825MHz Data Rate Output Power Rx Sensitivity	Data Rate	Output Power	Rx Sensitivity
	6Mbps	24dBm	-95dBm
	9Mbps	24dBm	-93dBm
	12Mbps	23dBm	-91dBm
	18Mbps	23dBm	-89dBm
	24Mbps	22dBm	-85dBm
	36Mbps	22dBm	-82dBm
	48Mbps	21dBm	-79dBm
	54Mbps	21dBm	-75dBm

Index MCS	IEEE 802.11gn /HT20				IEEE 802.11gn /HT40			
	Data Rate (Mbps)		Output Power dBm	Rx Sensitivity	Data Rate (Mbps)		Output Power dBm	Rx Sensitivity
	GI=800ns	GI=400ns			GI=800ns	GI=400ns		
MCS8	13	14.4	25	-95 dBm	27	30	24	-90 dBm
MCS9	26	28.9	25	-94 dBm	54	60	24	-90 dBm
MCS10	39	43.3	24	-92 dBm	81	90	23	-88 dBm
MCS11	52	57.8	24	-89 dBm	108	120	23	-85 dBm
MCS12	78	86.7	23	-86 dBm	162	180	22	-83 dBm
MCS13	104	115.6	22	-81 dBm	216	240	21	-78 dBm
MCS14	117	130.3	21	-80 dBm	242	270	20	-77 dBm
MCS15	130	144.4	21	-78 dBm	270	300	20	-74 dBm

Index MCS	IEEE 802.11an /HT20				IEEE 802.11an /HT40			
	Data Rate (Mbps)		Output Power dBm	Rx Sensitivity	Data Rate (Mbps)		Output Power dBm	Rx Sensitivity
	GI=800ns	GI=400ns			GI=800ns	GI=400ns		
MCS8	13	14.4	24	-94 dBm	27	30	22	-91 dBm



MCS9	26	28.9	23	-92 dBm	54	60	22	-89 dBm
MCS10	39	43.3	23	-90 dBm	81	90	21	-87 dBm
MCS11	52	57.8	22	-86 dBm	108	120	21	-84 dBm
MCS12	78	86.7	21	-83 dBm	162	180	20	-81 dBm
MCS13	104	115.6	20	-80 dBm	216	240	20	-77 dBm
MCS14	117	130.3	19	-78 dBm	242	270	18	-76 dBm
MCS15	130	144.4	17	-76 dBm	270	300	16	-73 dBm

Note: Output Power +- 1.5dBm

12. Hidden customization parameters

Hide customization parameters: hide page for custom parameter settings

■ ODM settings:

Please connect [http:// device IP address /__odm_settings__.html](http://device IP address /__odm_settings__.html), ODM hidden custom parameter settings, including:

- Vendor Name String
- Product Name String
- Radio Support
- Custom Logo

(Logo files size and specifications: 381 x 271 pixel; png file format)

For example, the IP address of the device is 192.168.100.121

In the device's Web browser input http://192.168.100.121/_odm_settings_.html can enter the ODM hidden custom parameter settings

(Note: the bottom line has two consecutive lines and one line difference)

ODM Settings

Vendor Name String

Product Name String

Radio Support

Radio 1 : 2.4 GHz 5 GHz

Radio 2 : 2.4 GHz 5 GHz

Radio 3 : 2.4 GHz 5 GHz

Upload custom logo

(Note: Restart your system to take effect. Logo: 381x271 pixel png format)

- ◆ Vendor Name String: Change the vendor name
- ◆ Product Name String: Change the product name
- ◆ Radio Support: You can set the frequency band supported by the RF card
 - Note1: When you want to change from the standard 5GHz single-frequency network card, to 2.4GHz & 5GHz dual-band network card, you must to modify the software here to identify the dual-band network card settings, otherwise the device software will only detection is defined as 5GHz single frequency network card.
 - Note2: When you set the 2.4GHz & 5GHz dual-band network card to use, but plug in 5GHz single-frequency network card, the device software will automatically detect the type of card you use.

Note: Changing the ODM Settings item must have permission to change the license of the parameter.

■ Upload custom logo: upload customization Logo

Upload custom logo

ODM password

(Note: Restart your system to take effect. Logo: 381x271 pixel png format)

- ◆ Logo size limit: 381 x 271 pixel
- ◆ Logo file format: png
- ◆ After uploading the Logo image, please reboot the wireless device; connect the computer equipment of the connection. Please clear the temporary file, history, cookie, etc. of the web browser.

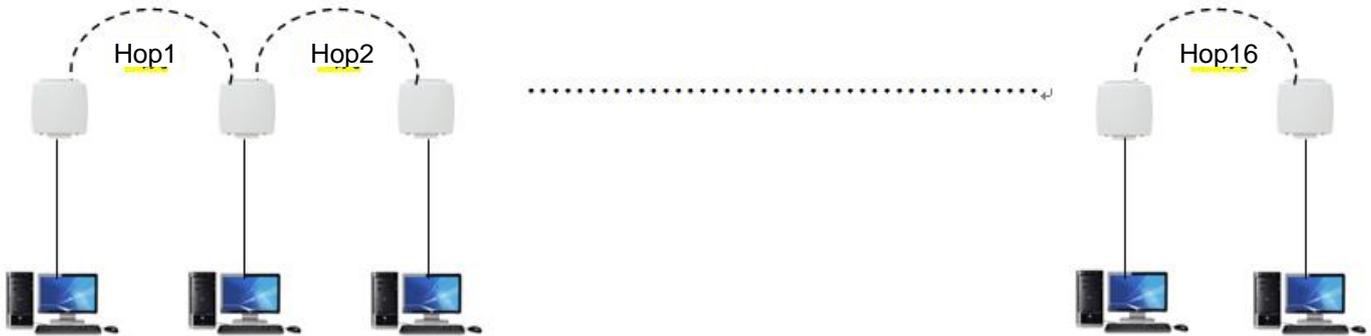
13. Performance test reference value

■ EL-N series wireless backhaul 16 hops transmission bandwidth test result

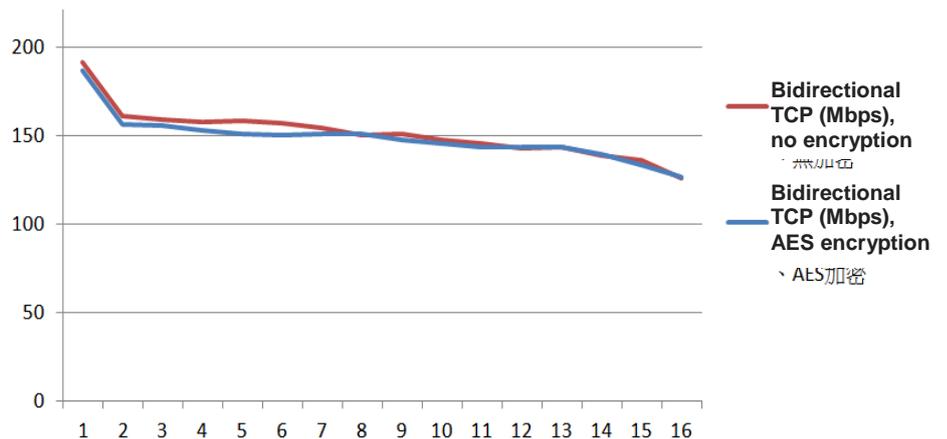
This chapter provides the reference for the performance test of the indoor laboratory system. The test conditions are:

1. Indoor laboratory to RF Cable to connect two devices, each device and RF Cable with 30dB attenuator, so all the way RF Cable plus 60dB attenuator.
2. When the device transmits the data, the RSSI value of each RF is between -50dBm and -60dBm.
3. Test to 2x2 MIMO-based.

◆ Test data reference:



Number of hops	Bidirectional TCP (Mbps), no encryption	Bidirectional TCP (Mbps), AES encryption
1	191.629	186.696
2	161.396	156.305
3	159.065	155.771
4	158.120	153.113
5	158.412	151.152
6	157.087	150.400
7	154.372	151.038
8	150.208	150.998
9	151.189	148.012
10	147.896	145.579
11	145.807	143.555
12	142.873	143.703
13	143.683	143.902
14	138.994	139.856
15	136.088	133.558
16	125.915	126.688





14. Other

■ EL-N Series 250 hops design instructions

EL-N series of original design is a wireless "completely" to replace the wired network research and development concept as a starting point, so in the construction of the overall network system, you can use wired network wiring thinking to plan the system.

In the wired network of the world node in series, the original is not the number of restrictions, EL-N also inherited this series of characteristics, so the number of wireless relay forwarding, but also can not limit the number of norms, but consider The overall network system delay (each time a relay will be more time-consuming 1ms), efficiency and general network packet TTL limit and other factors, EL-N software or limit the maximum relay forwarding platform relay number 250 hops.

Special Note

TTL: Time to Live the survival time of the packet.

In many network protocols will encounter packet delay, mainly packet transmission, are given TTL value (in seconds or hop count (hop) as a unit), packet transmission will be carried out after the countdown.

In the IP protocol, TTL is hop as a unit, each time through an "interface transfer" or "path routing" is reduced by one, if the packet TTL value is reduced to 0, the packet will be because "more than surviving Time "was discarded.

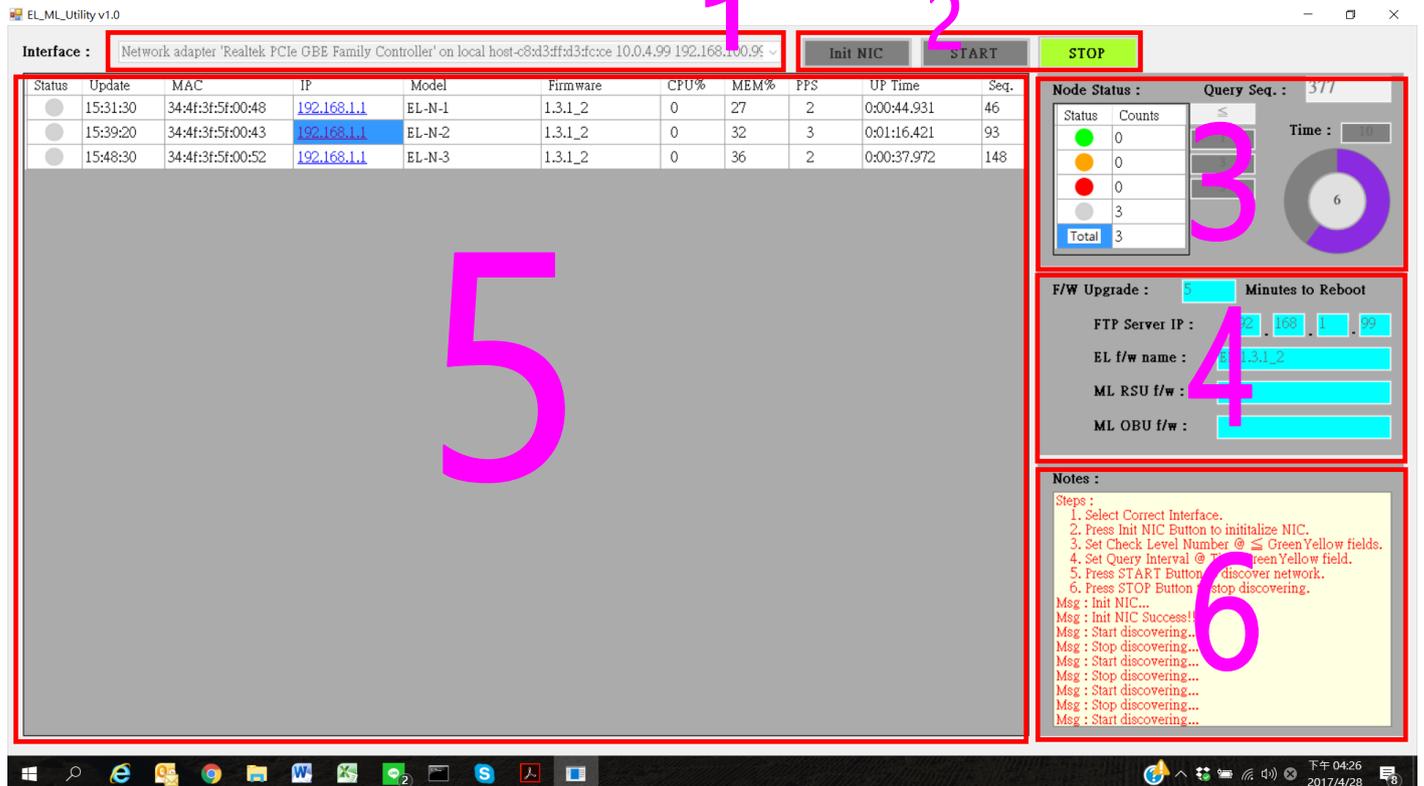
So when the packet in the delivery process, for some reason failed to reach the destination, you can avoid it has been full of the system network above, causing the system network confusion and congestion.

15. EL-N & ML-N Series Utility Simple Network Management Manual

- I. Version : 1.1
- II. Date : 2017/05/23
- III. Operating System : Windows
- IV. Applicable Equipment Model : EL-N-1 / EL-N-2 / EL-N-3, ML-N-1 RSU / ML-N-2 RSU / ML-N-3 RSU, ML-N-1 OBU / ML-N-2 OBU / ML-N-3 OBU
- V. Device Version: 1.3.0 or Later
- VI. Install the implementation: **Be sure to update the Microsoft 64-bit "vc_redist.x64" software (within the folder) and start the EL_ML_Utility_x64.exe in the folder to work properly.**
 ((32-bit system, please update "vc_redist.x86" and start the "EL_ML_Utility_x86.exe" software)

Special reminder1: Please MUST to stop firewall and anti-virus software first, and then install the job.

VII. Start Display :



The screenshot shows the EL_ML_Utility v1.0 application window. The interface includes a table of network interfaces, control buttons, and a status panel. Annotations 1 through 6 highlight specific features:

- 1:** Points to the 'Interface' dropdown menu.
- 2:** Points to the 'Init NIC' button.
- 3:** Points to the 'Node Status' panel, which includes a table of status counts and a gauge.
- 4:** Points to the 'F/W Upgrade' section, which includes fields for 'FTP Server IP', 'EL f/w name', 'ML RSU f/w', and 'ML OBU f/w'.
- 5:** Points to the main table of network interfaces.
- 6:** Points to the 'Notes' section, which contains a list of steps and messages.

Status	Update	MAC	IP	Model	Firmware	CPU%	MEM%	PPS	UP Time	Seq.
●	15:31:30	34:4f:3f:5f:00:48	192.168.1.1	EL-N-1	1.3.1_2	0	27	2	0:00:44.931	46
●	15:39:20	34:4f:3f:5f:00:43	192.168.1.1	EL-N-2	1.3.1_2	0	32	3	0:01:16.421	93
●	15:48:30	34:4f:3f:5f:00:52	192.168.1.1	EL-N-3	1.3.1_2	0	36	2	0:00:37.972	148

- Select the network interface card that can be connected to the device. Select the software will lock the card to perform this software, to change the other network interface card to scan, you need to restart the Utility software



Interface : Network adapter 'Realtek PCIe GBE Family Controller' on local host-c8d3:ffd3:fcce 10.0.4.99 192.168.100.99

Buttons: Init NIC, START, STOP

2.Action button

Init NIC

Will be selected interface card initialization, after the implementation of initialization, you will not change the interface card, if you want to change the interface card, please end the program re-implementation.

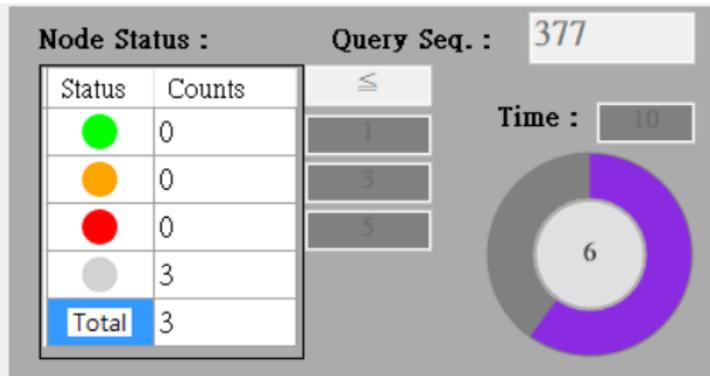
START

Start this Utility tool to get information.

STOP

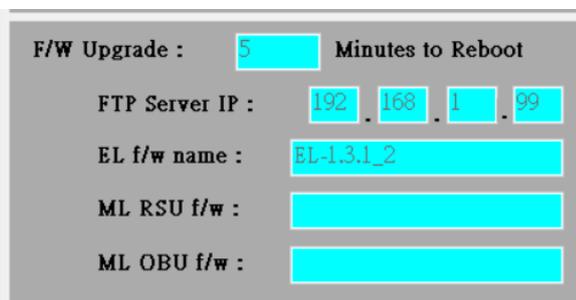
Stop this Utility tool to get information.

3.Operating Parameters



- **Time:** Set the query device time, the default for a minimum of 10 seconds query once, you can also set the scan detection once per minute, the equivalent of quarantine detection network management functions.
- **≤:** Set the device does not respond to the number of times the signal can be a long time through the scan signal and record the number of records to determine the wireless link connection and transmission stability.
- **Query Seq.:** The packet number sent to the device is calculated after each start of Start, and the packet number of the successful scan will be seen in the fifth block.

4.Device Software Update Parameters:



The screenshot shows a form with the following fields:

- F/W Upgrade :** A text box containing the value 5.
- Minutes to Reboot** (label next to the F/W Upgrade field)
- FTP Server IP :** A text box containing the value 192.168.1.99.
- EL f/w name :** A text box containing the value EL-1.3.1_2.
- ML RSU f/w :** An empty text box.
- ML OBU f/w :** An empty text box.

- **Minutes to Reboot:** After the device is touched by the software update, restart after x minutes, and the default is 5 minutes.
- **FTP Server IP:** Set the FTP server IP address, please use the Internet, download and install FTP Server software.
- **EL f / w name or ML RSU f / w or ML OBU f / w:** Set the software file name on FTP

<< Description: a. The software file name must last be "Software version number .img", for example: EL-en-1.3.0_2.img, where 1.3.0_2 is the software version number!

The device determines whether or not to update the software according to this version number. If the version number is consistent with the device version, no software update will be performed.

B. If the device determines that the software version is different, the device restarts after x minutes, regardless of whether the update is successful, so the device will restart, if the error is caused to cause the device to fail every time the update is completed. >>

5. Device Information List:

EL_ML_Utility v1.0

Interface : Network adapter 'Realtek PCIe GBE Family Controller' on local host-c8:d3:ff:d3:fc:ce 10.0.4.99 192.168.100.99

Init NIC START

Status	Update	MAC	IP	Model	Firmware	CPU%	MEM%	PPS	UP Time	Seq.
●	15:31:30	34:4f:3f:5f:00:48	192.168.1.1	EL-N-1	1.3.1_2	0	27	2	0:00:44.931	46
●	15:39:20	34:4f:3f:5f:00:43	192.168.1.1	EL-N-2	1.3.1_2	0	32	3	0:01:16.421	93
●	15:48:30	34:4f:3f:5f:00:52	192.168.1.1	EL-N-3	1.3.1_2	0	36	2	0:00:37.972	148

- Status: Include device response light (green / orange / red / gray)
- Update: Last response time
- MAC address
- IP address
- Equipment model
- Firmware version
- CPU %: CPU usage
- MEM %: MEM memory usage
- PPS: Counts the number of packets per second
- UP Time: Operation time of the device (calculated from the last change after setting up)
- Seq: Packet number of Seq device response

6. Notes (Message):

```
Notes :
Steps :
1. Select Correct Interface.
2. Press Init NIC Button to initialize NIC.
3. Set Check Level Number @ ≤ GreenYellow fields.
4. Set Query Interval @ Time GreenYellow field.
5. Press START Button to discover network.
6. Press STOP Button to stop discovering.
Msg : Init NIC...
Msg : Init NIC Success!!
Msg : Start discovering...
Msg : Stop discovering...
Msg : Start discovering...
```

- Message status list.