Installation Guide

of

MSR2000 Wireless Mesh Routers

Azalea Networks Co. Ltd

Standards and Regulations

◆ *Bureau of Radio Management of P. R. China*

Bureau of Radio Management of P. R. China is settled under the Ministry of Information Industry. All radio products and systems in China must be certified by it.

◆ *Federal Communications Commission (FCC)*

FC The Federal Communications Commission (FCC) is an independent United

States government agency, directly responsible to Congress. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications to this product not authorized by Azalea Networks USA, Inc. could void the FCC approval and negate your authority to operate the product.

To meet regulatory restrictions, the outdoor access point and external antennas must be professionally installed.

◆ *'UL'-Underwriters Laboratories*

The UL Marks are registered certification marks of Underwriters Laboratories Inc. (UL). UL is an independent, not-for-profit, product safety testing and certification organization. The UL Marks may only be used on or in connection with products certified by UL and under the terms of written agreement with UL.

◆ *'C'-Tick Mark*

The Australian Communications Authority (ACA) and the Radio Spectrum Management Group (RSM) of New Zealand have agreed upon a harmonized scheme in producing the C-Tick Mark that regulates product EMC compliance. All electrical and electronic products to be sold in the Australian and New Zealand markets must comply with the required applicable EMC emission standards which apply to both conducted and radiated emissions. Immunity requirements are not within the scope of the harmonized scheme. All products must also comply with applicable safety requirements.

◆ *Japan VCCI Mark*

Japan's VCCI Mark (Voluntary Control Council for Interference by Information Technology Equipment) is administered by VCCI for information technology equipment (ITE) sold in Japan. VCCI requirements are EMC only and based entirely on CISPR 22. The VCCI Mark is voluntary, although most ITE equipment sold in Japan show the VCCI Mark. Product quality is a perception gained by displaying the VCCI Mark.

Products accepted by the VCCI will have the right to display a proper VCCI label. The label for Class A products consists of a statement that the product has met VCCI requirements for RF emissions, whereas, Class B products only need to display a simple label.

◆ *European CE Mark*

The CE Mark is not a quality mark, but rather a symbol that indicates conformity to the legal requirements of the European Union (EU) Directive with respect to safety, health, environment, and consumer protection. All products offered for sale anywhere within the EU must have the mark or they cannot be sold.

The CE mark states that conformity must be achieved by meeting emission standards, both radiated and conducted, and immunity standards consisting of radio frequency radiated and conducted susceptibility, electrostatic discharge, power line surges and fast transients, voltage dips and interruptions, and power-frequency magnetic field.

Safety Warnings

MSR2000 must be installed by trained professional installation technician. All below warning information must be read before installation.

General Safety Warnings

⚠️ **Always be aware of electrical power lines!**

You can be killed or injured if performing antenna installation near electrical power lines. Carefully read and follow all instructions in this guide. Please be sure there are no high voltage and electronic field.

Lightning Activity Warning

⚠️ **Make sure not to connect or disconnect cables during periods of lightning activity.**

A surge protective device should be installed to prevent potential damage from very high surges, for instance, the peak surges caused by lightning.

Explosive Device Proximity Warning

⚠️ Do not operate wireless network device close to explosive merchandise or environment, for example, a vicinity to a gas station.

Antenna Placement Warning

Do not install any antenna near overhead power lines or other electric light, or where the antenna can come into contact with such circuits. When installing antennas, take extreme care not to come into contact with such electrical circuits, as they can cause serious injury or death.

Grounding Warning

Please always remember to protect your MSR2000 system by installation of grounding lines. The ground connection must be complete before connecting power to the MSR2000 enclosure. The requirement of grounding is to make sure the resistance must be less than 5 ohm between the ground termination point to grounding tier.

Power Installation Warning

The installation of power switch must be performed by a trained professional technician.

The power switch is not supplied with the MSR2000. The power cord must be assembled by a professional installer, and the final assembly must comply with related requirements.

Solar Irradiation and high Temperature Protection

Please pay attention of sunlight which will make the working temperature of MSR2000 higher then the specification

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MR2000 would be located under sunlight. The solar shield which provided in Azalea standard package should be installed to outdoor MSR2000. The Azalea Warrantee policy does not cover those outdoor products which Solar shield is not installed for it. Please contact Azalea technical support engineers for detail information.

Limited Warranty

Azalea Networks Co. Ltd will provide limited warranty services for MSR2000 products as:

➢ Limited warranty services will provide to Azalea contracted distributors or customers and warranty services agreement is signed as well.

➢ Azalea will provide one year warranty service if no other special agreement on warranty period.

➢ Warranty services period: the services last one year starting from the day after the material acceptance signed.

➢ Warranty Scope: The operation of MSR2000 must follow the operation guides provided by Azalea networks.

➢ Replacement Scope: Replacement will be done for customer when 1) the performance can reach figures in specification due to failures of design. 2) The products can not be recovered or repaired and the problem does not come from customers/distributors operation which does not follow Azalea operation guides.

➢ Azalea will provide repair service to customers and distributors by charging repairing and delivery cost when the warranty period is expired.

Contents

1 Introduction

1.1 MSR2000 Introduction

Azalea MSR2000 adopts technologies based on several patents or patents pending, and is the world's leading wireless mesh router, which is appropriate for fast outdoor large-scale wireless coverage of high quality and low cost. Azalea MSR2000 can help customers have application improvement, adjustment and added value, anywhere anytime and on-demand, with everything just easy, efficient and economic. The advantages of MSR2000 include:

◆ Multi-radio, multi-channel, which support scalable networks and make the deployment of mesh networks more flexible.

◆ High throughput, low delay

◆ Efficient routing

◆ Fast cross-subnet roaming

◆ Highly scalable

◆ Self-forming, self-healing

◆ End-to-end QoS support

◆ Reliable and secure

1.2 MSR2000 Appearance and Interfaces
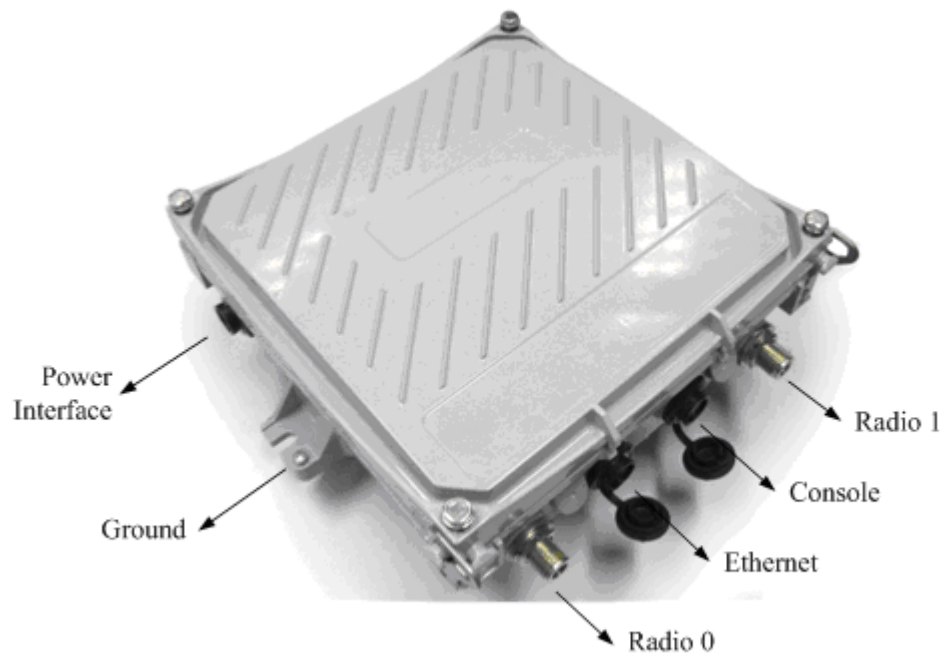
The ports of MSR2000 includes

- Ethernet Cable Interface

- Console Cable interface

- Power cable interface

- Radio Port 1

- Radio port 2

And, there is grounding terminal for connection of grounding wire.

1.3 Cables

1.1.1 Ethernet Interface

1. The black ethernet connector of MSR2000 is illustrated as the right graph:
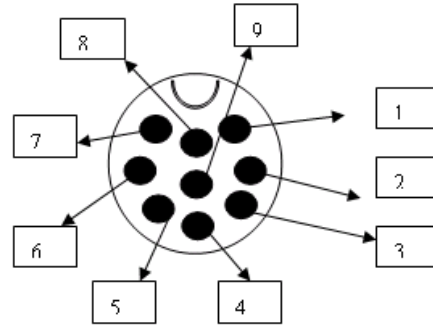
Ethernet Cable: Ethernet cable has 8
pins of 8 different colors as white green, green, white orange, orange, white
blue, blue, white brown, brown.

Connection methods:

White/green – 1st pin of 9 pins ethernet water protection connector

Green   – 7th pin of 9 pins ethernet water protection connector

White/orange   – 5th pin of 9 pins ethernet water protection connector

Orange   – 4th pin of 9 pins ethernet water protection connector

White/blue   – 2nd pin of 9 pins ethernet water protection connector

Blue   – 3rd pin of 9 pins ethernet water protection connector

White/brown – 6th pin of 9 pins ethernet water protection connector

Brown   – 8th pin of 9 pins ethernet water protection connector

Ground   – 9th pin of 9 pins ethernet water protection connector

2.   Crystal terminal

Crystal terminal follows the standard settings:

RJ45
Interface

1-white/orange, 2-orange,

3-white/green, 4-blue,
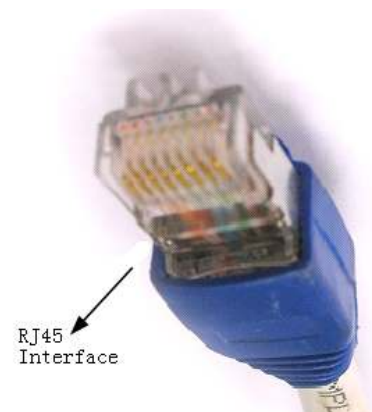
5-white/blue, 6-green,

7-white brown, 8-brown.

1.1.2 Console interface

1．The black connector is illustated as the right graph, which has 5 pins:

Console

Console line adopts 8 pins ethernet cable with 8 different colors as white green, green, white orange, orange, white blue, blue, white brown, brown.
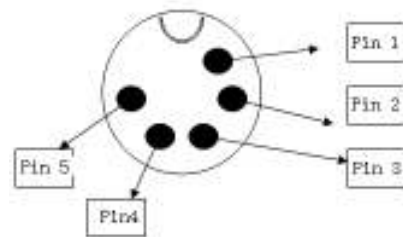
connection method of ethernet cable with black connector is as:

Pin 1
Pin 2
Pin 3
Pin 5
Pin4

      Orange   –1st pin of black connector

      White green   –2nd pin of black connector

      White blue   – 3rd pin of black connector

      White Brown – 4th pin of black connector

      Groud line   – 5th pin of black connector

2．DB9 Interface terminal:

DB9 cable is ethernet cable with 8 pins which is illustrated as the right picture:

DB9 Interface

The colors of 8 pins are: 1- white/orange, 2-white/green, 3- white/orange, 4-green,

5- white/blue, 6-blue,

7-white/brown, 8-brown.

Pin 2
Pin 1
Pin 5
Pin 9
Pin 6
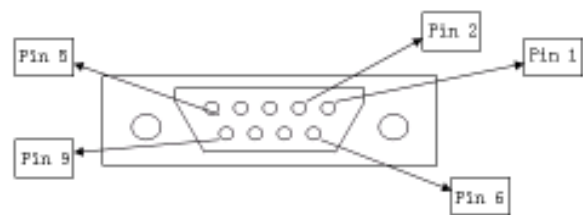
Connection method of DB9 connector with ethernet cable are:

Orange　　　– 3rd pin of DB9 connector

White/Green – 2nd pin of DB9 connector

White/Blue　– 5th pin of DB9 connector

(If the connector is crystal, the connection is as: 1-white/orange, 2-orange,3 white/green, 4-blue, 5-white/blue, 6-green, 7-white/brown, 8-brown)

1.1.3 Power cable

1．The black connector of power cable is shown as the right picture and illustrated as below graph, power cable connector has three pins with 3 different colors as red, black(or green),white(or yellow)

Power
Interface

Connection method of power connector with power cable is:

Red – 2nd pin of 3 pin power cable with water protection

Black(or green) – 3rd pin of 3 pin power cable with water protection

White (or yellow) – 1st pin of 3 pin power cable with water protection

Pin 1

Pin 2

Pin 3
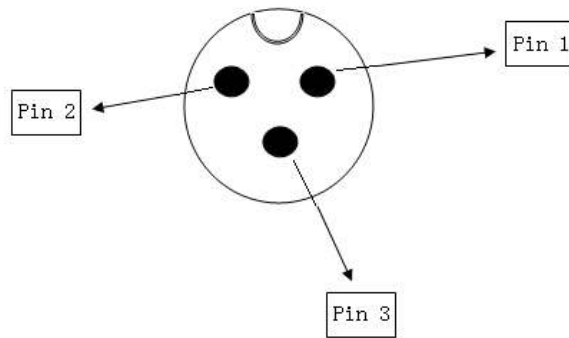
2 Preparation of Installation

2.1 Site Survey

Below chart shows general circle of mesh network deployment, and site surveyis is very important step in it to secure the solution works. All design aspects, such as site locations, site hunting, antenna height, antenna azimuth, antenna type, antenna downtilt degree, feeder length will be determined by site survey. The modification of solution could be done due to the availability of site is different with solution.
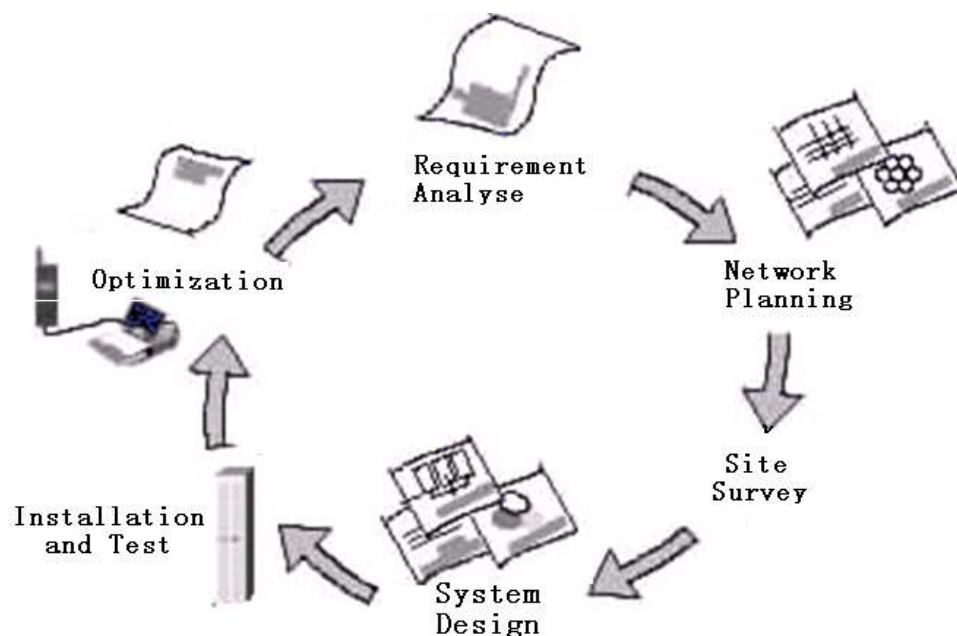
2.2 Site Survey Tools

The site survey tools should be prepared and checked before site survey, the survey tools include:

- ✔ PC
- ✔ GPS
- ✔ Compass
- ✔ Tape
- ✔ Digital camera

- ✔ Spectrum Scanner

- ✔ Telescope

- ✔ Spectrum Analyzer（Can be select）

2.3 The principle of site survey

The principles of site survey of MESH networks are as: Mesh No obstacle in 60% of the 1st fresnel zone. It will secure LOS in most area and the coverage capability is secured and number of sites could be saved.

1. If no LOS secured, area in NLOS area could be covered as well, but the distance of coverage and area of coverage are decreased, more sites are needed to provide coverage for same area than LOS scenario.

2. Interference must be considered in site suevey and site hunting, site location should be the place in low interference area to have good quality. Channel planning could help to avoid interference of narrow band.

2.4 Site Survey

Site survey mainly include site location selection and detail site informaton recording for selection of antenna and installation material design.

1.1.4 Site location selection

The site survey engineer should be very experienced and certified by Azalea networks. She/he should have good knowledge of wireless wave propagation, antenna and antenna near parts, MSR products and experiences in wireless network deployment.

Site location selection is the most important step of site survey. MESH network design engineer will do on site analysis of target area and recording all requirement site data, the site data includes terrain information, end-user distribution and their behavior, radio environment and the coverage target of

MESH networks. Power availability, line access availability , permit of antenna installation are mandatory aspects to be considered in site survey. It is suggested to hunt more locations than actual needs that back-up sites can be used if the availability of some sites changed. Actual measuremet is suggested done for complex radio environment. The idea site should meet following requirement:

- minimum obstacles to the target coverage area from the antenna.

- Availability of power

- Availability of Line access for Gateway

- Permit of antenna installation and MSR2000 mounting.

1.1.5 Detail measurement of site survey

Site survey engineer should conduct detail measurements according the plan, the measurements and records include site location information, antenna selection, MSR2000 mounting position etc. Site survey report is suugested to prepared after all site survey works finished.

➢ Eye measurement: building information, terrain information

Eye measurement is to verify there are any obstacle and reflection in wave propagation environment and terrain informing, such as building, trees, etc.

➢ Spectrum measurement (optional): radio environment

Spectrum measurement is to get familiar with radio environment in the target coverage area and antennas. The interference could from Wi-Fi APs and other systems.

➢ Site investgation: the availabity of power, installation of antenna and MSR2000.

2.5 Tools Preparation for Installation

✔ Safety tape, safety cap

✔ Insulation tool

✔ Installation Tool

- Measurement Tool

- Power Panel

- Template of Installation

2.6 Check before installation

- Check the complete of pole installation, the material of pole and its installation should comply related installation specification(Pole should be vertical, and grounding should be done, the diameter is around 40－60mm;

- Grounding is prepared already;

- Check the distance between MSR2000 and Grounding point;

- The cabling is mounted on wall or ceiling;

- Special installation material or tools are needed or not.

2.7 Check the equipment

- Check the integration of equipment list in the package;

- Check the integration of antenna, feeders and installation packages;

- Check the preparation of Adhesive Tape, PVC tape and strap to be enough for installation;

3 Installation Antenna

1．Principles of height of antenna installation:

➢ The antennas height for a MSR2000 site could be different. It would be determined by the apace of installation, and some times it is because of network design;

➢ The antenna height for access could be 20meters in open and flat area of city. It could be 30meters in open area in rural flat area;

➢ Too high antenna will decrease the coverage capability close to antenna, it is much popular when using omni antennas;

➢ Too high antenna will have another negative impact for system performance by interference to sites in surrounding areas. Its signal strength will reach very far away to interfere other sites.

2．Principles of Antenna azimuth:

➢ The main beam of antenna should point to the most dense traffic area to have better coverage and link quality;

➢ The overlapping coverage between two neighboring site should be less than 10% of its total coverage area in urban scenario;

➢ Overlapping area should not be too large in suburban and country area as well, and the angle of two neighboring antenna main beam should not be less than 90 degree;

➢ To avoid over coverage of an antenna, the antenna main beam should not point to the center of straight streets.

It should notice that the coverage capability changed if the azimuth of antenna adjusted, to improve coverage in one direction will give negative impact to other direction. The proper azimuth is very important in network building up stage.

3．The principles of antenna down-tilt angle desing:

➢ Down-tilt is widely used to have better coverage and less interference to neighboring sites;

➢ The down-tilt angle should be well designed, too high down-tilt will impact antenna beam form, and have the negative impact of coverage;

➢ The design of down-tilt antenna angle should consider the output power, antenna height, target coverage area, radio environment, etc. It should be done after site survey.
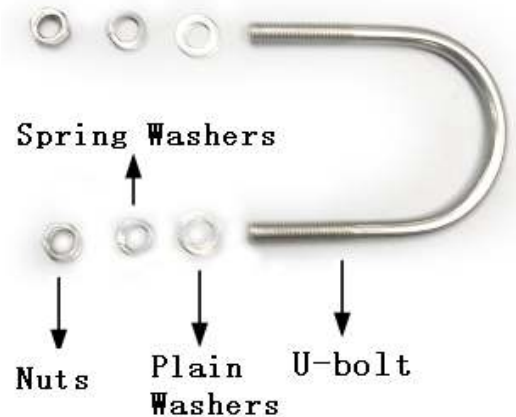
3.1 Installation of directional antenna

1.1.6 Assembling of installation accessories

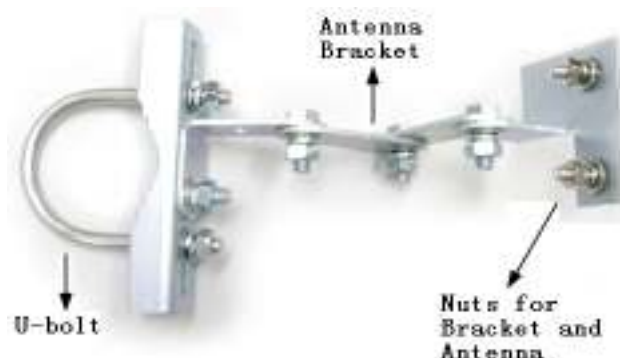Installation accessories of directional antenna includes:

- ✔ Antenna up-bracket

- ✔ Antenna down-bracket

- ✔ U-bolt

- ✔ Nuts to connect antenna and bracket

Tools of antenna installation

- ✔ Screwdriver

- ✔ Spanners

The procedure of antenna installation is:

1. Install U-bolt to arc side of antenna bracket

2. connect antenna and antenna bracket by tighting nuts
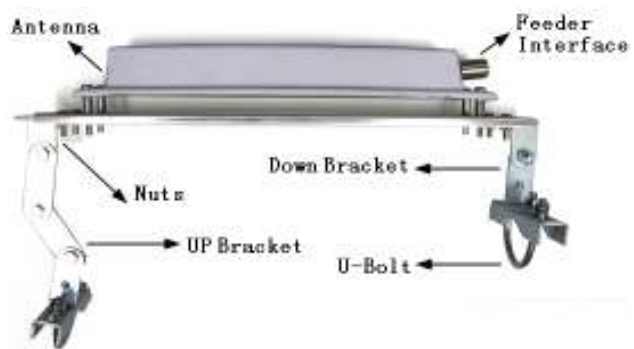
Plese notic the adjustable bracket should installed in upper position, that are more felixible to adjust downtilt angles.

1.1.7 Installation of Antenna

Tools: Spanners

1. The height f antenna must follow the requirement in desgin documentation (enough isolation should be secure between antennas, vertical isolution is much better than horizental isolation);

2. Put antenna to pole by U-bolt, start from upper U-bolt then down one;

3. Fix antenna on bracket, don't strengthen the nut too tight because the antenna azimuth will be adjusted.

1.1.8 Adjustment of Antenna Azimuth and Downtilt

Tools needed: Spanner, Compass, and Inclinometer.

Adjusting azimuth:

1. To measure the azimuth by compass;

2. Compare the difference between the actual azimuth with design value;

3. Slightly adjust azimuth to design value;

4. Measure the azimuth again to secure the difference less than 5 degree;

5. Fix the down U-bolt by screwdriver.

Adjusting down tilt angle:

6. Measure the down tilt angle by angle inclinometer;

7. Compare the difference between actual figure with design value;

8. Slightly adjust the downtilt angle by stretching or shrink the up-bracket.

9. Measure the down-tilt angle again to secure the difference between actual downtilt angle and actual one less than 0.5 degree;

10. Fasten nuts in upper bracket to complete the installation of directional antenna.

3.2 Installation of Omni antenna

Tools:

Adjustable Spanner

Installation material package of omni antenna includes:

✔ Omni antenna:

✔ Installation bracket of omni antenna(2 sets of fasten nuts included)

The procedure of omni antenna installation is:

1. Mount the bracket to pole by one set of nuts, fasten the nuts by Spanner;

2. Mount the omni antenna to the bracket by another set of nuts;

3．Adjust antenna to secure it installed vertically;

4．Fasten the nuts by Spanner.

⚠ Safety protection must be guaranteed when aloft work

⚠ The installation should be done by experienced antenna installer. Power line and high electronic field must be avoided.

⚠ Don't stand on side of antenna of MSR2000 when MSR2000 is operating, there are strong electromagnetic field there when MSR2000 is operating.

⚠ Don't do any installation works during raining time.

4 Installation of MSR20000

Material package of MSR2000 installation
includes: MSR2000

- ✔ 1 MSR2000

- ✔ 1 Solar shield

- ✔ 1 Installation Bracket

- ✔ 2 pipe holders (mounted on pole)

- ✔ 4 expansion bolts (mounted on wall)

- ✔ 9 set of nuts for solar shield and bracket (one set is backup)

4.1 Assembling of bracket with solar shield

Tool: Spanner

The procedure of assembling bracket with solar shield is as:

1．Connect bracket with solar shield by nuts;

2．Fasten nuts by Spanner;

⚠️ IF no solar shield, the temperature would be very high by sunlight.

3．Remove the 2 accessories of MSR2000 by Spanner;

4．Put MSR2000 into solar shield;

5．Connect MSR2000 with solar shield by nuts.

Connect
Nuts

Connect Nuts
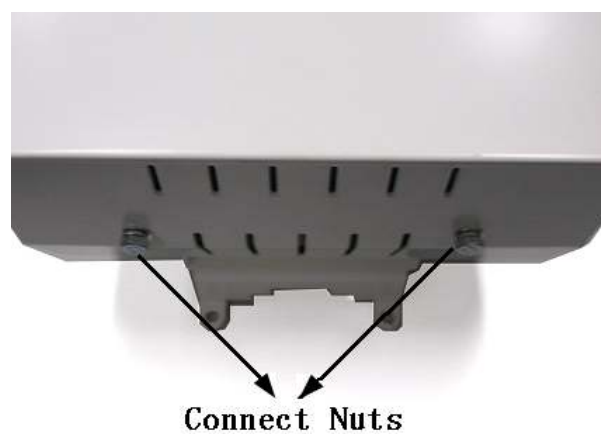
6．Fasten all nuts by Spanner.

4.2 MSR2000 installation

1.1.9 Install MSR2000 on Pole

Tool: Straight Screwdriver.

The procedure of installing MSR2000 on pole is: MSR2000:

1．Put pipe holder cross bracket;

2．Mount MSR2000 on pole;

3．Move MSR2000 to proper position;

4．Fix the MSR2000 by fasten pipe holder with screwdriver.

1.1.10 Install MSR2000 on Wall

Tools needed:

Mark pen, Percussion drill, Percussion Drill Hammer, and adjustable Spanner.

The process of installing MSR2000 on a wall is as:

1．Put the bracket on the MSR2000 installation position and mark the 4 position of nut holes;

2．Drilling on the 4 mark positions;

3．Hit expansion bolts into wall;

4．Put MSR2000 on the expansion bolts;

5．Fasten nuts by Spanner.

1.1.11 Grounding of MSR2000

The grounding of MSR2000 is to protect MSR2000 not damaged by electrostatic, there are grounding terminal on the enclosure of MSR2000.

Tools needed: Paper knife, Pliers, Crimping Pliers, and Cross Screwdriver.

The procedure of grounding is as:

1.　Put naked side of grounding line into the copper ring, and press it well by Crimping Pliers;

2．Un-mounted the screw of in the grounding terminal.

3．Put the copper ring into the grounding terminal.

4．Fasten the screw by Cross Screwdriver;

5．Connect the another side of grounding wire with grounding bar;

6． Daub butter on both side of grounding wire

⚠ Grounding must not be skipped in the MSR2000 installation, and it must be finished before power on of MSR2000.The residence of grounding wire must be less than 5 ohm.

5 Installation of lightning protector

The lightning protector is to protect MSR2000 to avoid damage by burst high current by lightning. Lighting protector should be installed between radio port and antenna feeders, and be connected with lightning system of the building as well. Lightning protector should be installed close to MSR2000.

Tools needed: Paper knife, Pliers, Crimping Pliers, Cross Screwdriver, and Spanners.

The procedure of lightning protector installation is as:

1．Connect the lightning protector to radio port of MSR2000;

2．Fasten the lightning protector by Spanner;

3．Unpack the copper ring of grounding.

4．Put the naked side of grounding wire into copper ring and pressed well by Crimping Pliers;

5．Connect the grounding copper ring with lightning protector and fasten it by Cross Screwdriver;

6．Connect the another side of grounding wire with grounding bar;

7．Daub butter on both side of grounding wire;

6 Installation of Feeder

Feeder is used to connect antenna with MSR2000. The feeder must be as short as possible to get minimum loss of signal strength. If long feeder must to be used,
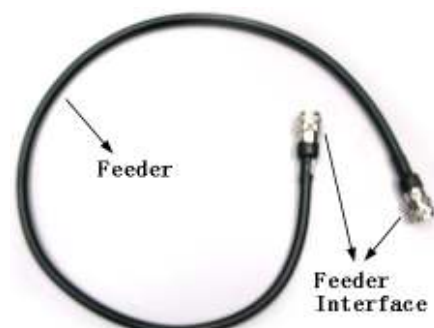
thicker feeder is recommended.

The typical pass loss of 100 meters is listed in below table:

Feeder type	Cable loss for 2.4GHz (dB/100m)	Cable loss for 5.8GHz (dB/dB/100m)
3/8"	18.8	31.7
1/2"	12.8	21.4
7D	25.7	42.6
8D	24.8	41.3

Tools needed for feeder installation: adjustable Spanner, paper knife, Diagonal Pliers.

The procedure of feeder installation is as:

1．Put feeder interface close to antenna connector very well and slightly fasten the connection by circling the feeder connector;

2．Fasten the connector by Spanner;

3．Cabling the feeder following the pole, and be careful of the beauty of cabling, and without any sharp band of the cable.

The radius of cable bend should less than following figures of different types

Cable type	Cable Bending Radius (mm)
3/8"	95
1/2"	125
7D	60
8D	75

4．connect another connector to lightning protector;

5．Fix the feeder on pole by black sheaf rope and don't hang the feeder on the air;

Tie Use
Sheaf
Rope

6．Airproof the connectors by insulating tape and PVC insulating tape.

7 Installation of Ethernet cable

Ethernet cable connects MSR2000 mesh network to line network, only gateway needs line connection. The performance of network cable should be less than100 meters to secure the good performance, so the length of Ethernet cable is suggested less than 50meters in MSR nodes planning.

Connect Ethernet

The process of Ethernet cable installation

1．Unpack cap on the Ethernet interface.

2． Connect Ethernet cable terminal to MSR2000 Ethernet interface.

3． Plug the Ethernet cable emphatically into the MSR2000 Ethernet interface, and fasten the connection by circling the Ethernet terminal to the right direction.

4． Airproof the connection by insulating tape and PVC insulating tape.

8 Installation of power cable

MSR2000 use 110-220V AC as power, the power interface is on the left and upper position of MSR2000. The cabling of antenna cable is introduced in chapter 2.3. The installation of power cable is the last step of installation.

Tools: Diagonal Pliers，paper knife

The procedure of power cable installation:

1． Put the power terminal to MSR2000 power interface quite well;

2． Plug the terminal of power cable emphatically and fasten the connection by circling the power terminal to right direction;

3．Airproof the connection by insulating Adhesive Tape and PVC insulating type;

4．Fix the power cable follow the pole and don't let the power cable hang in the air.

5．Another side of power cable connects air switch.

⚠ Installation of power cable must be done by experienced power cable installer, and read the installation manual before installation.
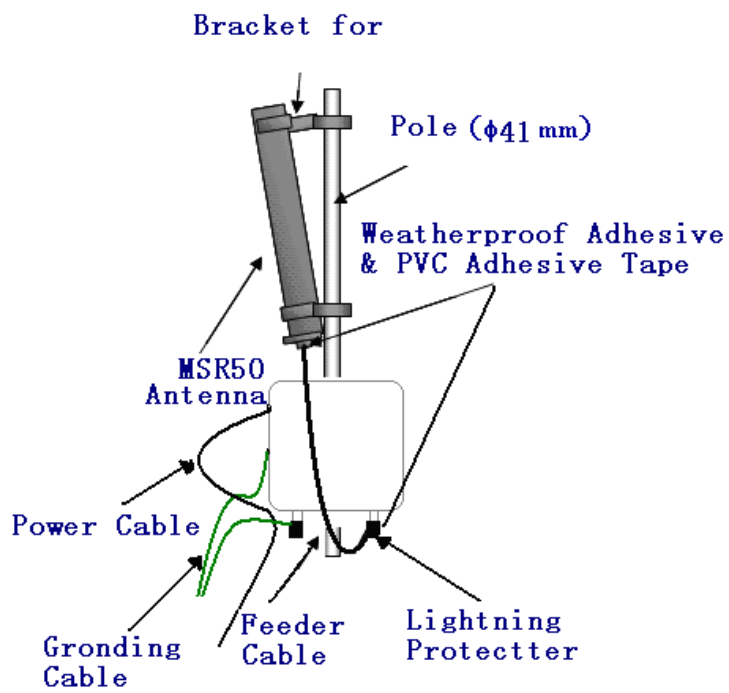
⚠ Be sure of installation of grounding is completed then power on MSR2000.

9 Whole picture of Installation

Picture of actual site of completed installation:

All parts of installed site are illustrated as below graph:

Appendix

1. MSR2000 specifications

- 802.11a/b/g

- Dual radio

- Antenna changeable

- Power range: 110 ~ 250 VAC

- Power consumption: <7W

- Output power: 100mw(20dBm)

- Operating temperature: -45 ~ +55℃

- Storage temperature:-50 ~ +85℃

- Operating humidity: 10%~90%

- Wind Survivability: <165mph

- Weather rating: P67

- Shock & Vibration: GB6587.4-86

2．MSR2000 dimension

- Length: 25mm

- Width: 24mm

- Height: 105mm

- Weight: 3kg

- Chassis material : Aluminum

- Chassis color : Smoky gray

3．Frequency and Channel

- P. R. China

  Frequency: 2.400 -2.483GHz, 5.725 -5.85Ghz

  Channel:1－13,   149－165

- The United States

  Frequency: 2.400 -2.483GHz, 5.15 -5.35Ghz, 5.725 -5.825Ghz

  Channel: 1-11, 36-64, 149-165

- Europe

  Frequency: 2.400 -2.483GHz, 5.15 -5.35Ghz, 5.47 -5.725Ghz

  Channel: 1-11, 36-64, 94－145

- Japan

  Frequency: 2.400 -2.483GHz, 4.90 -5.091GHz, 5.15 -5.25GHz

  Channel: 1-14, 36－48

4．Modulation Mode:

- 802.11b/g: DSSS (DBPSK, DQPSK, CCK); OFDM (BPSK,QPSK, 16-QAM, 64-QAM)

- 802.11a: OFDM(BPSK,QPSK, 16-QAM, 64-QAM)

5．Throughput：

- 802.11a/g： 6, 9, 12,18, 24, 36, 48 ,54Mbps

- 802.11b: 1, 2, 5.5,11Mbp