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ZXMBW E9230
Compact Base Station (outdoor)
User Manual

Revision History

Revision No.	Revision Date	Revision Reason
R1.1	07/15/2009	Optimize Manaul
R1.0	05/15/2009	First Edition

Serial Number: sjzl20092846

Contents

Preface

Purpose
ZXMBW E9230 is an outdoor compact base station and one of WiMAX broadband radio access products. It provides IP-based voice and video services in hot spots, blind spots, rural and suburbs, railways and highways.

This manual describes system compositions, functions, principle, networking, technical indices and engineering installation of the ZXMBW E9230.

Intended Audience
This document is intended for engineers and technicians who perform operation and installation activities on the ZXMBW E9230.

Prerequisite Skill and Knowledge
To use this document effectively, users should have a general understanding of wireless telecommunications technology. Familiarity with the following is helpful:

- The ZXMBW E9230 system and its various components
- User interfaces on the ZXMBW E9230
- Local operating procedure

What is in This Manual
This manual contains the following chapters.

Chapter	Summary
Chapter 1 Product Overview	Introduces the position, functions, principles, external and internal interfaces, applications and technical indices of the ZXMBW E9230.
Chapter 2 Hardware Description	Describes the cabinet structure, hardware modules, antenna feeder system and external cables of the ZXMBW E9230.
Chapter 3 Equipment Installation	Describes the installation flow, installation preparation, cabinet installation, power cable installation, hardware installation check, and power-on and power-off procedures of the ZXMBW E9230.

FCC Compliance Statement
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.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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Product Overview

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ZXMBW E9230 Position in the Network

ZXMBW E9230 is located in the radio access layer of WiMAX networks and used to provide broadband radio access for users in outdoor hot and blind spots, suburbs, rural areas, railways and highways.

Figure 1 shows the position of the ZXMBW E9230 in the WiMAX network.

FIGURE 1 ZXMBW E9230 POSITION IN THE NETWORK
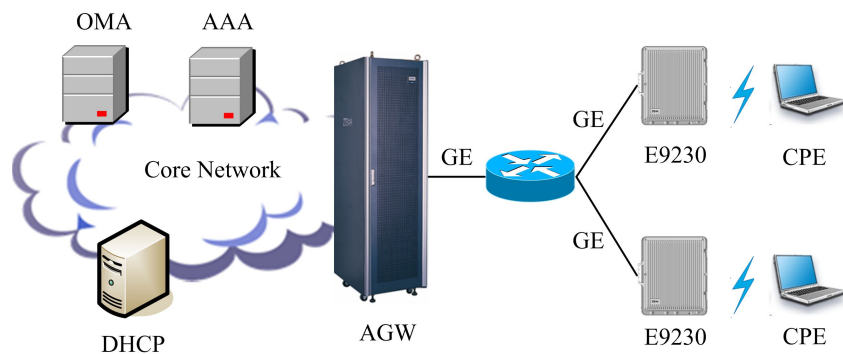
Table 1 describes the meanings of these NEs.

TABLE 1 NE MEANING

NE	Meaning
AAA	Authentication, Authorization, Accounting
AGW	Access Service Network Gateway
E9230	Compact Base Station (outdoor)
CPE	Customer Premises Equipment
DHCP server	Dynamic Host Configuration Protocol server
OMA	Operation, Maintenance and Administration

Functions

The ZXMBW E9230 provides the following functions.

Forward Signal Processing
- Performs OFDMA modulation, MAC layer processing, digital up-conversion, intermediate frequency amplification, RF power amplification and transmit filtering on received baseband signals and then transmits them by using the antenna.
- Implements MAC layer scheduling and power control.
- Detects baseband signal power and antenna interface power in FPGA of the digital domain.
- Accomplishes wave standing ratio detection on the forward antenna interface.
- Implements forward automatic calibration and manual calibration.

Reverse Signal Processing
- Receives reverse RF WiMAX signals from space and performs band pass filtering, low noise amplification, RF RF mixing and digital down-conversion on these signals and then sends them to the baseband OFDMA modulation and MAC layer processing. Afterwards, the baseband sends these signals to AGW through the R6 interface for interconnection with the core network.
- Supports reverse RSSI and reverse spectrum scan functions.
- Accomplishes reverse automatic gain control.

Clock Processing
- Implements GPS clock signal abstraction and clock recovery.
- Supports clock cascading.
- Accomplishes clock signal distribution.

Other Functions
- Monitors and manages WDPA signals.
- Monitors and manages the power supply.
- Monitors and manages the electrically tuned antenna.
- Monitors external equipments through dry contacts and RS485 interface.
- Implements TDD time sequence regeneration.
- Accomplishes version monitoring and version management.

■ Implements master/slave R6 interface processing and R6 interface Ethernet convergence.

Appearance

The dimensions of the ZXMBW E9230 cabinet are 370mm (W)× 320mm (D) ×165mm (H). Figure 2 shows the ZXMBW E9230 appearance.

FIGURE 2 ZXMBW E9230 APPEARANCE
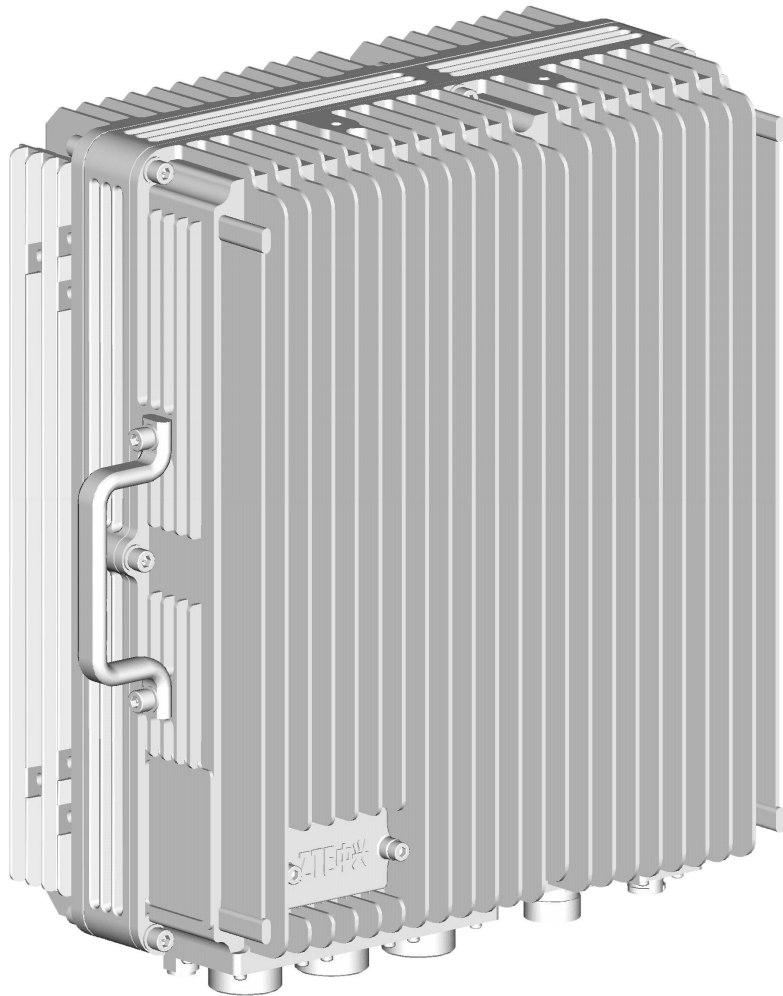
Fundamental Principle

The ZXMBW E9230 implements the radio access function for outdoor coverage systems.

It provides the following functions:

- Exchanges radio signals with the ATs in its coverage through the WiMAX air interface and controls radio channels.

- Communicates with BTSs.

- Modulates and demodulates baseband signals.

- Implements system clock synchronization.

- Receives and transmits RF signals.

- Implements power control.

The ZXMBW E9230 is composed of a baseband intermediate frequency board (MTRW), a digital predistortion high power amplifier (WDPA), an RF front end filter (WRFE) and power module WRPM.

Figure 3 illustrates the ZXMBW E9230 composition.

FIGURE 3 ZXMBW E9230 COMPOSITION
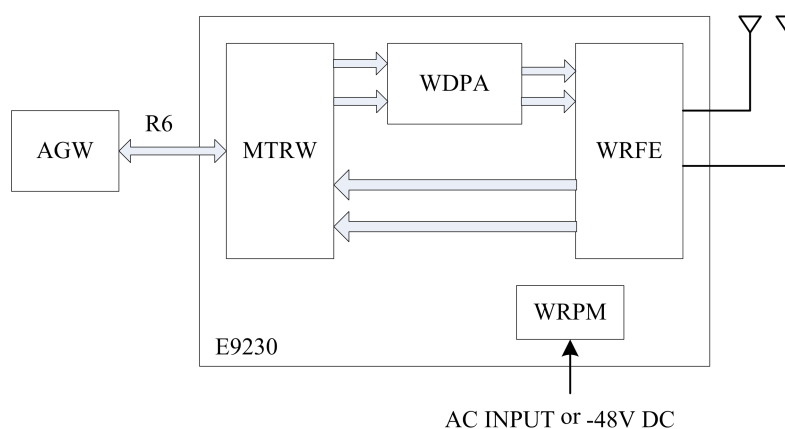
The ZXMBW E9230 processes the following basic services:

- Forward service

    The core network sends IP packets to the ZXMBW E9230 through the transmission network. After receiving these packets, the MTRX unit of the ZXMBW E9230 disassembles them and then sends to the baseband process unit for encoding and modulation. Afterwards, these IP packets are sent to the RF process unit for up-conversion and power amplification before being transmitted to ATs.

- Reverse service

    The signals from ATs are down converted by the RF process unit of the ZXMBW E9230 and then sent to the baseband process unit for channel modulation. Afterwards, these signals are sent to the CPU control unit for IP packing and then transmitted to the core network through the transmission network.

External Interfaces

Figure 4 shows the external interfaces of the ZXMBW E9230.

FIGURE 4 EXTERNAL INTERFACES
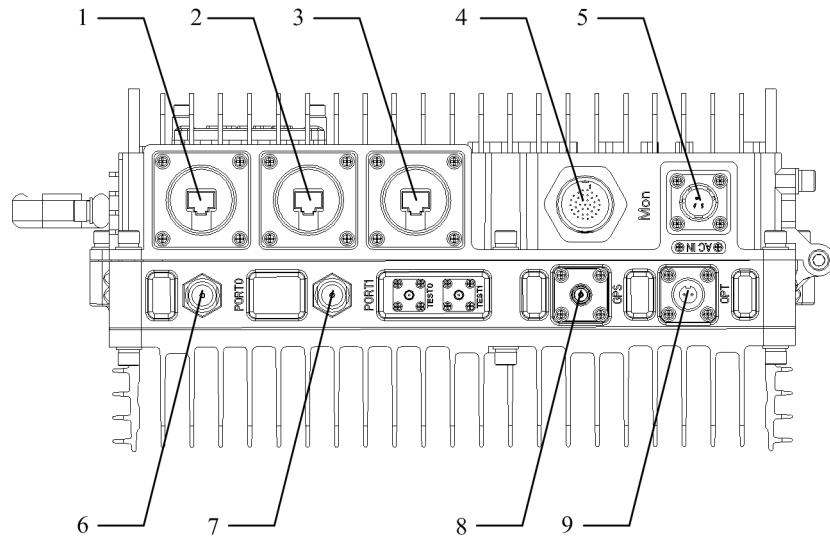
1. Gigabit Ethernet electrical inter-
   face
2. Gigabit Ethernet electrical inter-
   face
3. Gigabit Ethernet electrical inter-
   face

4. Monitoring & maintenance cascade
   interface
5. Power interface
6. RF antenna feeder interface
7. RF antenna feeder interface
8. GPS antenna interface
9. Gigabit Ethernet optical interface

Table 2 describes these external interfaces.

TABLE 2 EXTERNAL INTERFACE DESCRIPTION

Sequence No.	Interface Description	Connector	Quantity
1	Electrically tuned antenna interface	8–core aerial connector	1
1, 2 and 3	Gigabit Ethernet electrical interface	Electrical interface connector assembly	3
4	Monitoring & maintenance cascade interface	37–core aerial connector assembly	1
5	DC power interface	Power connector assembly	1
6 and 7	RF antenna feeder interface	N-female	2
8	GPS antenna interface	TNC-female	1
9	Gigabit Ethernet optical interface	Optical interface connector assembly	1

– The ETH0 interface with sequence No. of 1 is shared by R6 interface and electrically tuned antenna interface. The interface is used for different purposes according to the configuration requirement.

ⓘ **Note:**

The electrically tuned antenna interface and the R6 interface that the star network supports are mutually exclusive. In the case of electrically tuned antenna, ETH0 is occupied. In this case, only the R6 interface daisy cascading is supported while the R6 interface star cascading is not supported.

Networking Application

The ZXMBW E9230 supports multiple networking applications.

ZXMBW E9230 Independent Networking Application

Figure 5 illustrates the ZXMBW E9230 independent networking application.

FIGURE 5 INDEPENDENT NETWORKING APPLICATION
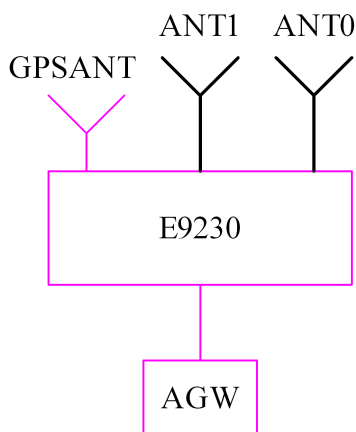
Star Networking Application

Figure 6 illustrates the ZXMBW E9230 R6 interface star networking application.

FIGURE 6 ZXMBW E9230 STAR NETWORKING APPLICATION
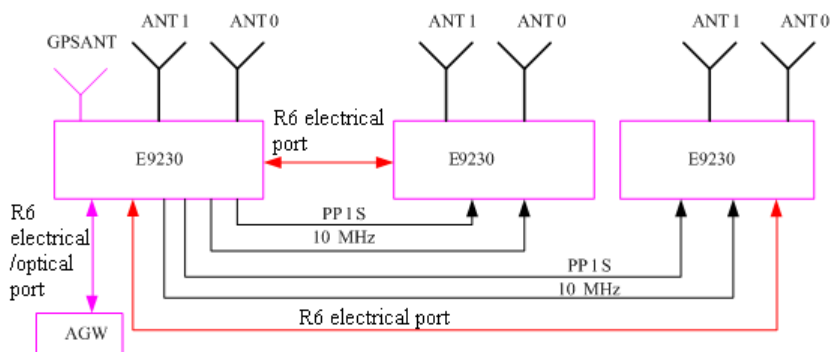
Daisy Networking Application

Figure 7 illustrates the ZXMBW E9230 R6 interface daisy networking application.

FIGURE 7 ZXMBW E9230 DAISY NETWORKING APPLICATION
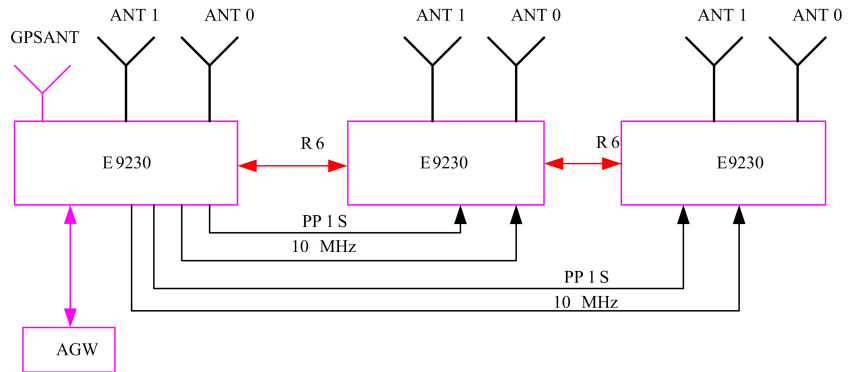
Technical Indices

Engineering Indices

Table 3 gives ZXMBW E9230 engineering indices.

TABLE 3 ENGINEERING INDICES

Index	Description
Dimension	370mm (W) ×320mm (D) ×165mm (H)
Weight	15 kg
Power Supply	-48V DC
Temperature of working environment	-40℃~55℃
Humidity of working environment	Relative humidity range: 5%~95%
Overall power consumption	< 200 W
Protection level	IP65
Overall size	< 20 litres
Overall power of power supply	< 200 W
Heat dissipation	Self-cooling

Performance Indices

Table 4 lists the performance indices of ZXMBW E9230.

TABLE 4 PERFORMANCE INDICES

Index		Description
RF	Band class	2496 MHz~2690 MHz
	Carrier bandwidth	5 MHz and 10 MHz 1–carrier support 2 x 10 MHz and 2 x 5 MHz 2–carrier support
Duplex mode	FDD/TDD	TDD
System indices	Carrier	1 carrier or 2 carriers
	MIMO	2×2 MIMO
	Output power	2 x 40 dBm (10W)
Modulation mode		QPSK, 16QAM and 64QAM
Antenna		Electrically tuned antenna (optional)
R6 interface		Optical interface or electrical interface
Overall noise		No noise
Maintenance		It supports remote upgrading. It supports the local OMC and Debug interface.
Environmental protection		It meets the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (ROHS) and Waste Electrical and Electronic Equipment Directive (WEEE) of the European Union.
Heat dissipation		Self-cooling
Followed standards		IEEE 802.16-2005 WiMAX Forum TM Mobile Radio Conformance Tests
Lightning protection		DC: A built–in 15KA lightning arrester meets the level C requirement.
Installation mode		It supports outdoor pole—mount installation and wall-mount installation.

Clock Parameter

The ZXMBW E9230 supports 3 levels of master/slave clock cascading.

Environmental Indices

Table 5 gives the environmental indices of the ZXMBW E9230.

TABLE 5 ENVIRONMENTAL INDICES

Index			Description
Working environment			Outdoor areas (higher than 4K2)/4Z5/4Z7/4B1/4C2/4S3/4M3
Biological environment (4B1)	Plants		Anti-mould and anti-fungus
	Animals		Anti-rodent but not anti-termites
Chemical material condition (4C2)	Salt fog		Salt spray proofing
Mechanical material conditions (4S3)	Sand	mg/m3	1000
	Dust (floating)	mg/m3	15
	Dust (sinking)	mg/m2.d	1000
Climatic environment	Temperature	℃	-40 ~ 55
	Relative humidity	%	5 ~ 95
	Temperature change rate	℃/min	0.5
	Pressure	kPa	70 ~ 106
	Solar radiation	W/m2	1120
	Dewdrop		It meets the dewdrop requirement.
	Precipitation (rain, snow and hail)		It meets the precipitation requirement.
	Rainfall intensity	mm/min	6
	Rainwater temperature	℃	5

Index			Description
	Freezing and frost		It meets the freezing and frost requirement.
	Maximum wind speed	m/s	50

Compliance Standards

The ZXMBW E9230 complies with the following standards:

- IEEE Standard 802.16-2005Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems
- WiMAX ForumTM Mobile Radio Conformance Tests (MRCT)
- WiMAX ForumTM Mobile Protocol Implementation Conformance Statement (PICS) Proforma
- WiMAX ForumTM Mobile System Profile

Protocol Interface Description

ASN Network Reference Model

Figure 8 illustrates the ASN network reference model formulated by WiMAX NWG.
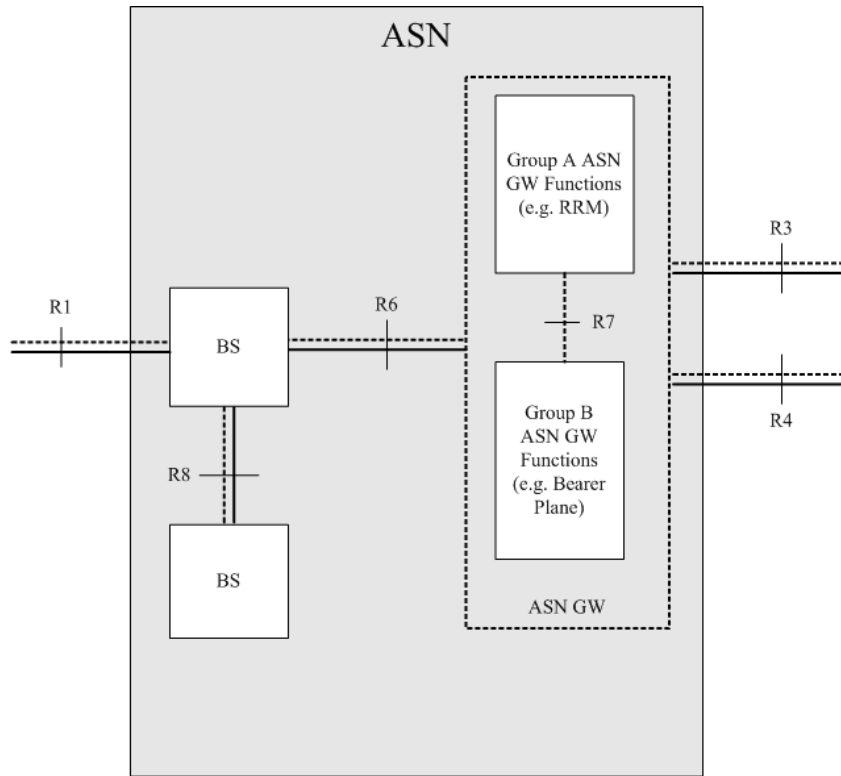
Table 6 describes these interfaces.

TABLE 6 ASN INTERFACE DESCRIPTION

Inter-face	Description
R1	Air interface between AT and RRU
R3	Interface between AGW (also called Access Service Network GateWay (ASN-GW)) and the core network
R4	Interface between ASNs or AGWs. It implements handoff related signaling and data channel that is set up to maintain data consistency during handoff.
R6	Interface between AGW and BTS
R7	(Optional) Internal interface of AGW. It divides AGW into the policy decision part and the policy realization part.

Protocol Interfaces

ZXMBW E9230 supports R1 interface and R6 interface, as shown in Figure 9.

FIGURE 9 ZXMBW E9230 INTERFACES
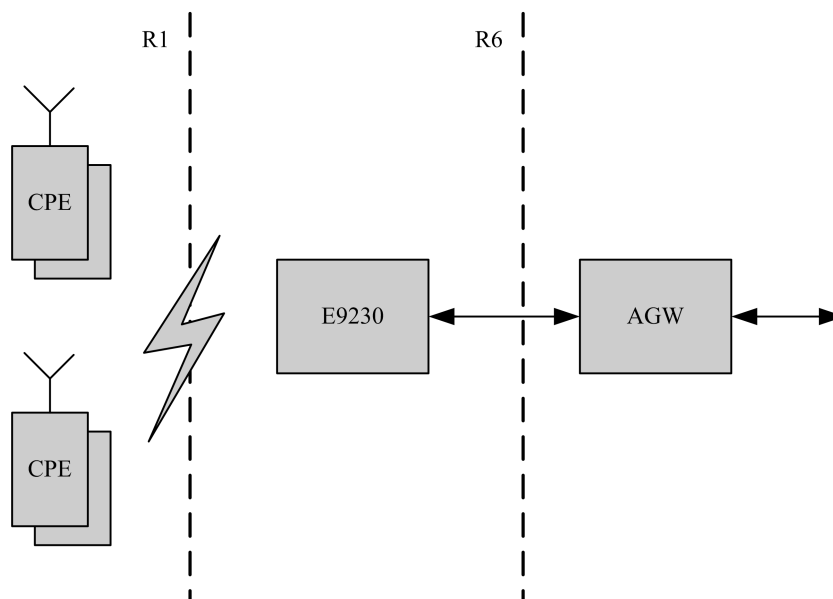
The following is the description of the interfaces.

- R1 interface

  R1 interface is the interface between the BS and the MS, containing MAC layer, physical layer and relevant management plane. It complies with the 802.16e protocol.

- R6 interface

  R6 interface is between the BS and the AGW. It contains the data plane and control plane.

  ▸ Data plane

    Data plane is the IP tunnel between the AGW and the BS. It is used to differentiate the traffic flows with different Quality of Service (QoS) levels.

  ▸ Control pane

    Control plane supports the tunnel management, Authentication, Authorization, Accounting (AAA) and Radio Resource Management (RRM) functions.

R1 Interface

Short Description R1 interface is the interface between the BS and the MS, containing MAC layer, physical layer and relevant management plane. It complies with the 802.16e protocol.

Message Format Table 7 describes the MAC layer management message format of the R1 interface.

TABLE 7 R1 MESSAGE FORMAT

| Content	Description
Message Type	The first field of every management message is **Message Type**. To know the value of this field, refer to the content of MAC management message in the protocol.
Non-TLV field	This field is sequenced strictly according to the definition of message format. The corresponding values of various fields are sorted strictly according to the sequence defined by the message format.
TLV field	This field is a triple field, that is, type-length-value. The message sorts the triple of such field according to the actual situation.

Protocol Stack The R1 interface contains MAC layer and physical layer. The MAC layer contains three sub-layers, that is, service-specific Convergence Sub-layer (CS), MAC Common Part Sub-layer (MAC CPS) and security sub-layer in the top-down sequence.

CS sub-layer: The CS sub-layer converts/maps the external data received by CS-SAP into MAC SDU and transmits the data to MAC CPS through MAC SAP. The sub-layer classifies external Service Data Units (SDUs) and associates them with proper SFIDs and CIDs. It supports the payload head compression function and provides various service-specific convergence sub-layer specifications for different external protocol interfaces.

MAC CPS sub-layer: The MAC CPS sub-layer does not resolve the payload at the CS sub-layer. The MAC CPS sub-layer supports the core functions of the MAC layer, including bandwidth request, connection setup and maintenance. It receives data of various CS sub-layers through the MAC SAP and classifies these data by different MAC connections. Its QoS is applied to transmission and scheduling above the physical layer.

- Security sub-layer: The MAC layer contains an independent security sub-layer that provides authentication, safe key exchange and encryption.

- The physical layer has multiple specifications, each of which corresponds to a specific frequency range and application. Figure 10 illustrates the R1 interface protocol stack.

FIGURE 10 R1 INTERFACE PROTOCOL STACK
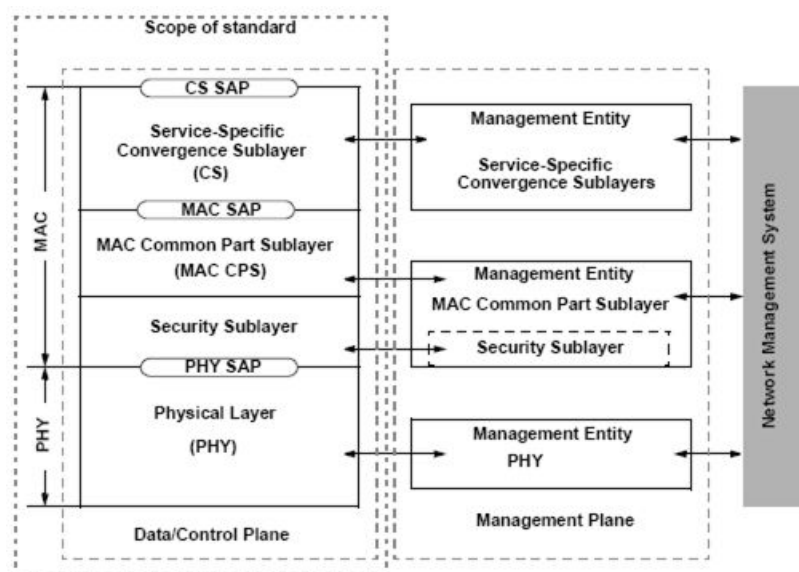
Physical Layer   The R1 interface adopts Orthogonal Frequency Division Multiplexing (OFDM) at the physical layer.

R6 Interface

R6 interface defines the processing flow between BS and ASN-GW. The signaling between the BS and the ASN-GW is transmitted through the R6 tunnel in the format of User Datagram Protocol (UDP) plus the signaling format defined by NWG stage 3. The media plane data is borne over the encapsulation tunnel protocol.

UDP bears R6 signaling. Generic Routing Encapsulation (GRE), Multiple Protocol Label Switching (MPLS) and Virtual Local Area Network (VLAN) bears R6 data.

The ASN-GW terminates the R6 tunnel from the BS. The R6 tunnel can adopt various encapsulation technologies, such as GRE, MPLS and VLAN, and different tunnel granularities are allowed. The R6 data path supports encapsulation protocol and tunnel granularity negotiation.

Control Plane Message Format   Figure 11 describes the control plane message format of the R6 interface.

FIGURE 11 R6 CONTROL PLANE MESSAGE FORMAT

Table 8 lists the description of the field in the R6 control plane message (following the byte order).

TABLE 8 R6 CONTROL PLANE MESSAGE FIELD DESCRIPTION

Field	Description
Version	Protocol version number.
Flags	Byte length.
Function Type	Indicates the function, such as HO Control.
OP ID	Indicates the operation type.
Message Type	Message type corresponding to Function Type, such as HO_Req.
Length	Message length, including the message head.
MSID	MAC address of the MS that is related to the message. If the message is not related to any specific MS, all bits of this field are set to 0.
Reserved	32 reserved bits, which are set to 0.
Transaction ID	Transaction ID. If it is 0, the message should be discarded.
Reserved	Reserved bit, which is set to 0.
Destination Identifier TLV (Type/Length/Value)	Length-variable destination entity identifier. For example, the destination to which the message is to be sent is the network node ID of a functional entity. The message receiver checks whether Destination Identifier in the message head is the same as its own Identifier before accepting the message. If yes, the receiver will process this message. If no, the receiver will transit

Field	Description
	the message to the destination identifier without changing it.
Source Identifier TLV	Length-variable source entity identifier, for example, the network ID of a functional entity that originates the message.
TLVs	A triplet following the message head.

Figure 12 illustrates the detailed format of the **Flags** field.
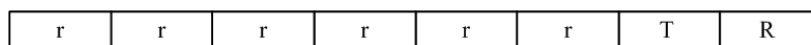
FIGURE 12 FLAGS FIELD FORMAT

r	r	r	r	r	r	T	R

Table 9 lists the **Flags** fields and their description.

TABLE 9 FLAGS FIELD DESCRIPTION

Field	Description
r	Reserved bit, which must be set to 0. The receiver should ignore the reserved bit.
T	If this bit is configured, the message should contain **Source Identifier TLV** and **Destination Identifier TLV**.
R	Resets the next expected **Transaction ID**.

Control Plane Protocol Stack

Figure 13 illustrates the structure of the R6 control plane protocol stack.

FIGURE 13 R6 CONTROL PLANE PROTOCOL STACK
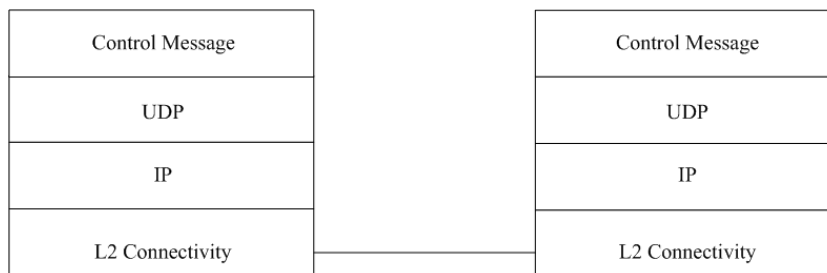
A logical connectivity between L2/L3 of two control plane protocol stacks enables communication between the two functional entities. The encapsulation of IP packets between the two functional entities relies on the connectivity type, such as GRE tunnel. The seal of the encapsulated packet contains address information, which ensures that the packet can be sent to the correct physical entity.

Physical Layer

The physical layer of the R6 interface supports packet access and Time Division Multiplexing (TDM) access.

Packet access: 10M/100M/1000 MBps FE electrical port; 1000 MBps Ethernet optical port

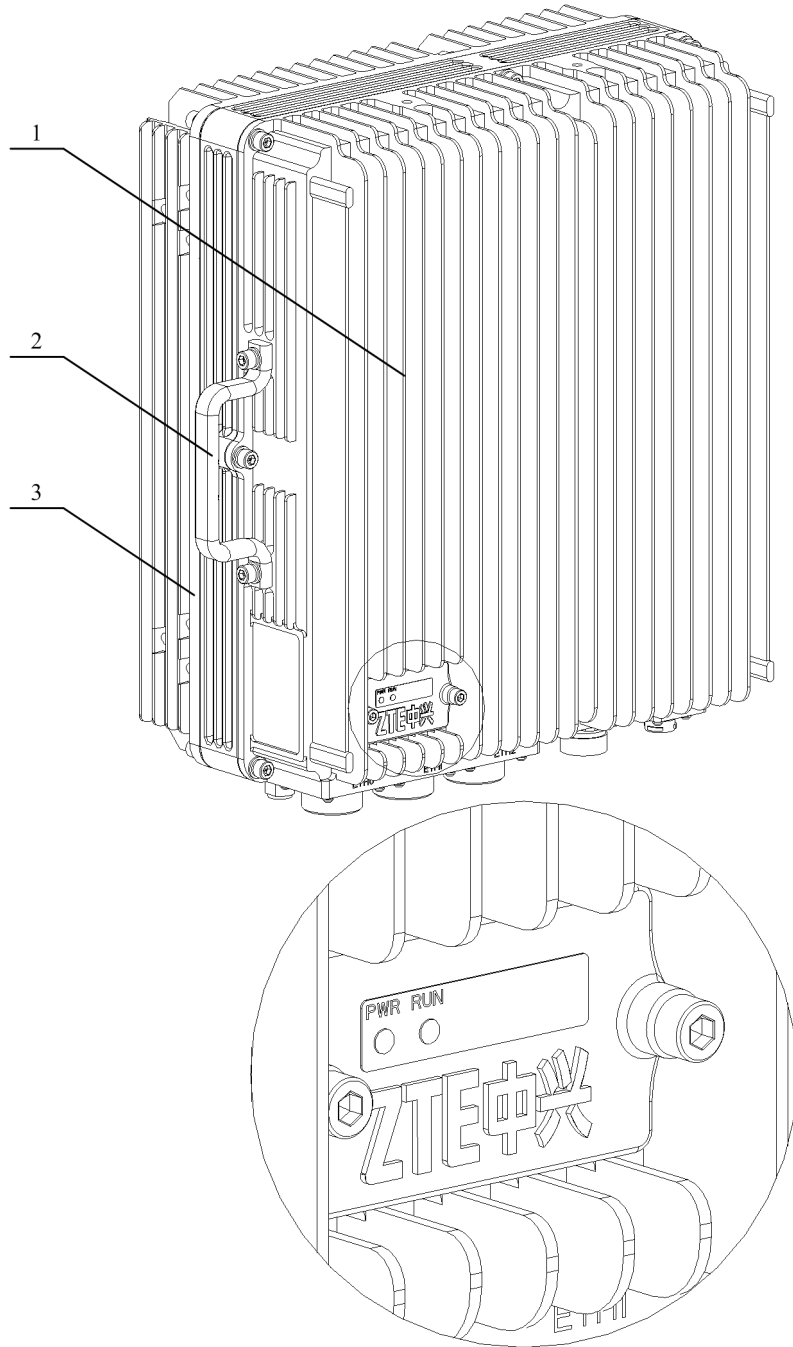This page is intentionally blank.

Hardware Description

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Cabinet Structure

Figure 14 shows the structure of the ZXMBW E9230 cabinet.

FIGURE 14 ZXMBW E9230 CABINET STRUCTURE

 Note:

Do not open the ZXMBW E9230 cabinet. Contact ZTE engineers to open it for maintenance.

Hardware Modules

ZXMBW E9230 mainly consists of four modules: baseband intermediate frequency board MTRW, WiMAX Digital Power Amplifier (WDPA), WiMAX RF Front End Filter (WRFE), and WiMAX RRU Power Module 2 (WRPM2) DC power supply module.

MTRW Module

The baseband RF module MTRW is the core module of ZXMBW E9230. The MTRW module provides the following basic functions.

1. MAC layer functions, including scheduling, power control, and OMC.

2. Physical layer functions, including OFDMA modulation and demodulation of baseband signals.

3. RF forward channel functions, including up-converting, Digital Predistortion (DPD) processing, and power amplifying of baseband signals, as well as energy conversion between the electric field and the magnetic field.

4. Reverse functions of the RF channel, including receiving, amplifying, and down-converting of RF signals.

5. Clock processing functions, including GPS signal receiving and clock processing.

6. Cascading and convergence of the R6 daisy chains and stars of the active/standby E9230, as well as clock cascading.

7. Management, monitoring, and maintenance functions of the E9230.
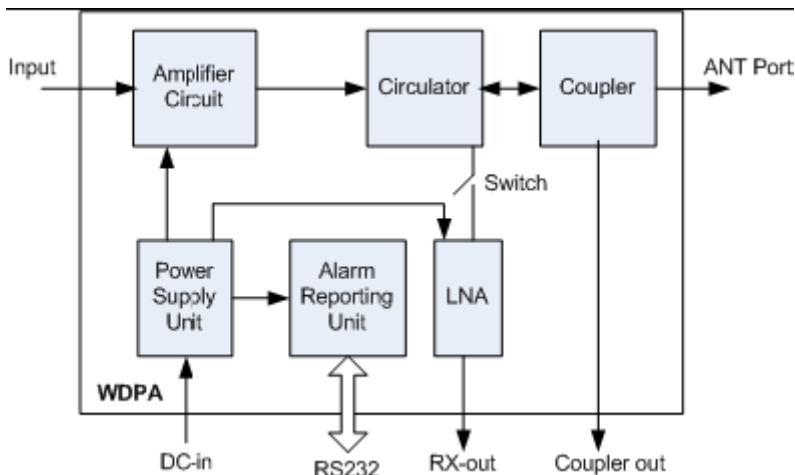
WDPA Module

The WDPA module amplifies the RF power.

Function   The WDPA module provides the following functions:

- RF amplification
- Voltage Standing Wave Ratio (VSWR) measurement
- Alarm reporting

Working Principle   Figure 15 shows the working principle of the WDPA module.

FIGURE 15 WDPA WORKING PRINCIPLE

The WDPA module consists of an Amplifier Circuit, Circulator, Coupler, Power Supply Unit, Alarm Reporting Unit, and LNA .

- Amplifier Circuit provides the main RF amplification channel.
- Circulator separates the receiving and sending signals.
- Coupler extracts the RF signals transmitted by the BS for monitoring and measurement.
- Power Supply Unit provides power for each unit.
- Alarm Reporting Unit reports such alarms as temperature, high/low power and standing wave alarms.
- Low Noise Amplifier (LNA) amplifies the received signals.

WRFE Module

The WRFE module is the WiMAX RF Front End Filter module of ZXMBW E9230.

Function   The WRFE module provides the following functions:

- Provides the RF interface to transfer RF signals to the antenna.
- Filters RF signals.
- Provides RF unit lightning proof function.
- Isolates uplink from downlink.

Performance Specifications   Table 10 lists the performance specifications of the WRFE module.

TABLE 10 WRFE PERFORMANCE SPECIFICATIONS

Index	Range
Frequency range	2496 MHz ~ 2690 MHz

WRPM Module

In ZXMBW E9230, the WiMAX RRU Power Module (WRPM) is responsible for power supply conversion.

Function The WRPM module provides the following functions:

- Power supply conversion
- Lightning proof
- EMI filtering
- Power supply management and alarm reporting

Working Principle Figure 16 show the working principle of the WRPM module.

FIGURE 16 WRPM WORKING PRINCIPLE (DC)
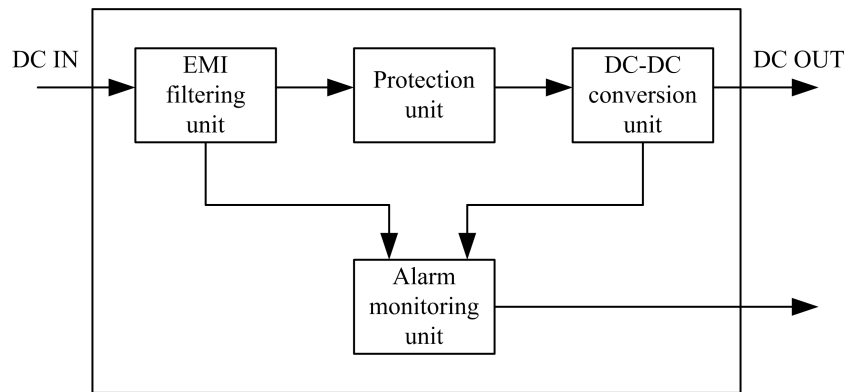
The WRPM module consists of EMI filtering unit, protection unit, DC-DC conversion unit, and alarm monitoring unit. The functions of the units are described as follows:

- The EMI filtering unit provides the filtering function.
- The protection unit provides over-voltage or under-voltage protection.
- The DC-DC conversion unit implements power supply conversion.
- The alarm monitoring unit reports such alarms as under-voltage, over-voltage and over-current alarms.

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C h a p t e r   3

Equipment Installation

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Components to be Installed

Installation components include:

1. ZXMBW E9230 cabinet

    > 🔲 **Note:**
    >
    > The cables inside the ZXMBW E9230 cabinet and function mod-
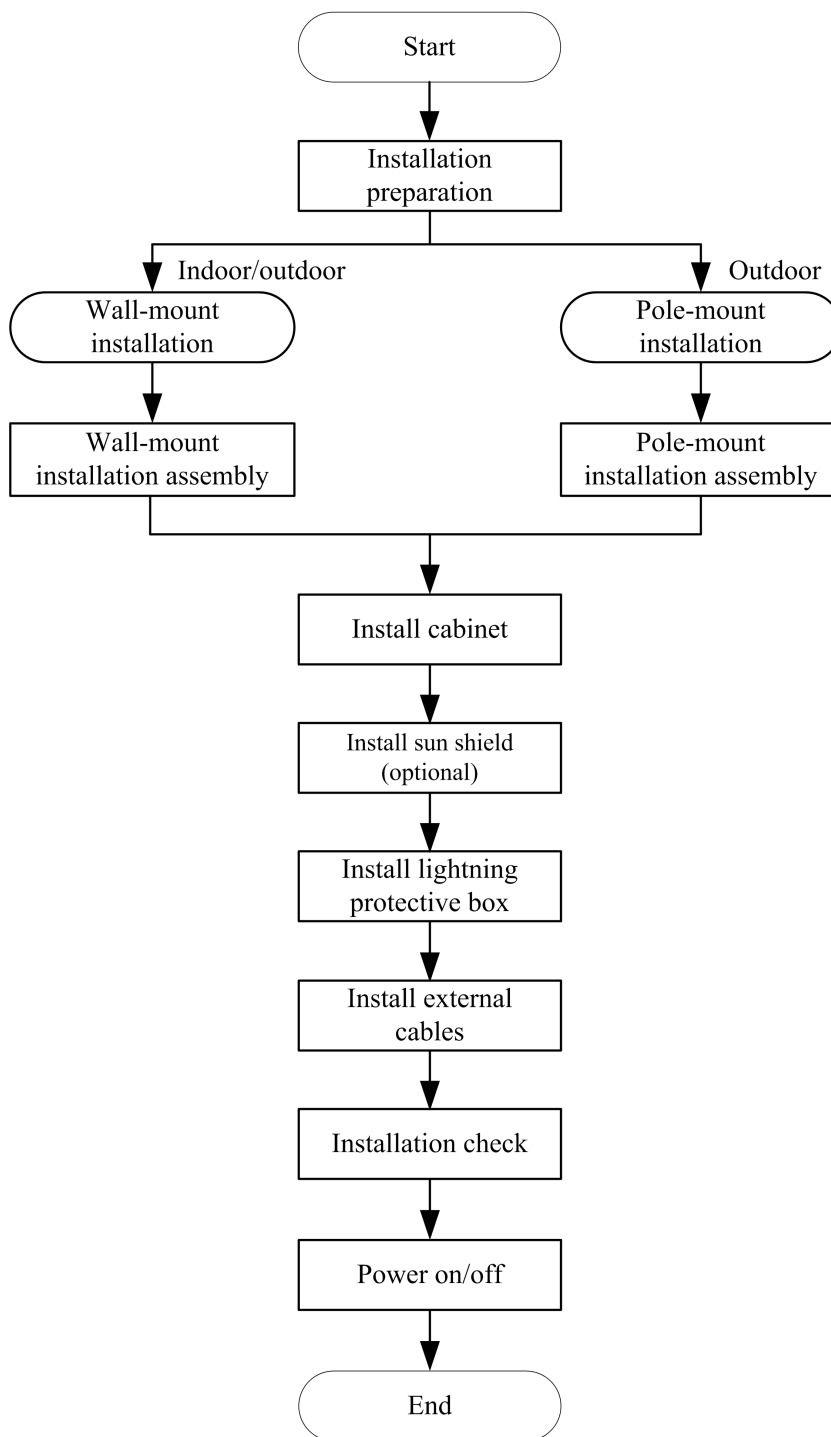   > ules have been installed before shipment.

2. External cable

3. Main antenna feeder system (including antenna, feeder and
    main feeder)

Installation Flow

illustrates the installation flow of ZXMBW E9230.

FIGURE 17 ZXMBW E9230 INSTALLATION FLOW

```
                    ┌──────────────┐
                    │    Start     │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │ Installation │
                    │ preparation  │
                    └──────┬───────┘
            Indoor/outdoor │        Outdoor
         ┌─────────────────┴────────────────────┐
  ┌──────▼───────┐                        ┌──────▼───────┐
  │  Wall-mount  │                        │  Pole-mount  │
  │ installation │                        │ installation │
  └──────┬───────┘                        └──────┬───────┘
  ┌──────▼───────┐                        ┌──────▼───────┐
  │  Wall-mount  │                        │  Pole-mount  │
  │ installation │                        │ installation │
  │   assembly   │                        │   assembly   │
  └──────────────┘                        └──────────────┘
                           │
                    ┌──────▼───────┐
                    │Install cabinet│
                    └──────┬───────┘
                    ┌──────▼───────┐
                    │Install sun shield│
                    │  (optional)  │
                    └──────┬───────┘
                    ┌──────▼───────┐
                    │Install lightning│
                    │protective box│
                    └──────┬───────┘
                    ┌──────▼───────┐
                    │Install external│
                    │    cables    │
                    └──────┬───────┘
                    ┌──────▼───────┐
                    │Installation check│
                    └──────┬───────┘
                    ┌──────▼───────┐
                    │ Power on/off │
                    └──────┬───────┘
                    ┌──────▼───────┐
                    │     End      │
                    └──────────────┘
```

Installation Precautions

ZXMBW E9230 technical personnel must check equipment running environment before installation. Moreover, they must know about communication networking, data configuration, status of equip-

ment in the network, interfaces of line transmission equipment and lengths of various cables prior to installation.

Pay attention to the following:

1. Avoid installing the cabinet in the power-on status.

2. Avoid performing outdoor installation while lightning or thunder storm occurs.

3. Perform an airtight test before RRU delivery, and prohibit disassembling the RRU on site.

4. Replacing any parts or making any changes to the equipment might result in an unexpected danger. Therefore, be sure not to replace any parts or perform any changes to the equipment unless authorized otherwise.

Installation Preparation

Installation Environment Check

Before installing equipment, check installation environment according to every items of requirements in *Environment Acceptance Report*.

Installation Position Requirements

The installation position of ZXMBW E9230 must accord with the requirements of engineering designs. The detailed requirements are described as follows.

- Locate away from areas that are full of dust, harmful gases and explosive goods.

- Locate away from areas that have big shake or strong noise.

- Locate away from industry boilers and heating boilers.

- Locate away from a vent of smoke pipe.

- Locate away from water flowing areas.

- Locate away from high power radio interference source.

- Locate away from a substation.

- Locate away from pollution source.

Temperature and Humidity Requirements

describes temperature and humidity requirements of ZXMBW E9230 work environment.

TABLE 11 TEMPERATURE AND HUMIDITY REQUIREMENTS

Item	Requirement
Environment temperature	-40ºC ~ 55 ºC
Storage environment temperature	-45ºC~+85ºC
Environment humidity	5%~95%

Power Supply Requirements

Table 12 describes power supply requirements of ZXMBW E9230 cabinet.

TABLE 12 POWER SUPPLY REQUIREMENTS

Category	Requirement
DC	-36 V -60 V DC

⚠️ **Caution:**

Make sure that the power polarities are consistent during installation; otherwise, the equipment may be damaged.

Other Preparation

1. Check whether relevant devices or components accord with the requirements of engineering design drawing.

2. Wrap cable connectors with insulating tapes before laying power and protective earthing cables.

3. Separately lay out power and protective earthing cables according to the same signals.

Tools and Instruments Preparation

Table 13 shows tools and meters list required during installation.

TABLE 13 TOOL AND METER LIST

Category	Name
Special-purpose tools	One feeder connector knife
	One wire stripper One crimping pliers
	One multi-functional crimping pliers Earth resistance tester
Concrete drilling tools	One electric percussion drill
	Auxiliary and sample bits
	One vacuum cleaner
	Power socket (two-phase and three-phase socket, with current capacity greater than 15 A)
General-purpose tools	Cross screwdrivers (4", 6" and 8" each)
	Flathead screwdrivers (4, 6" and 8" each)
	Adjustable wrenches (6", 8", 10" and 12)
	Dual-purpose spanners (17" and 19" each)
	One set of socket wrench
	5 kg (11 lb) nail hammer
	One 300 W iron
	One 40 W iron
	Solder wires
	Hot blower
	Oil paint brush
	Pliers
	Scissor
	Paper knife

Category	Name
Measurement tools	One 50 m (164 feet) tape measure
	One 5 m (16 feet) steel tape
	One 400 mm (16 inches) level bar
	One angle meter
	One compass
	Plumb
Protection tools	Antistatic wrist strap
	Safety helmet
	Pair of gloves
Clamp tools	One hacksaw (with several saw blades)
	One pair of sharp-nose pliers (8″)
	One pair of diagonal pliers (8″)
	One pair of slip joint pliers (8″)
	One pair of vices (8″)
	Crowbar
Auxiliary tools	Chain wheel
	Rope
	Ladder
	Forklift

Installing Cabinets

Installation Mode Introduction

The installation modes of ZXMBW E9230 involve wall-mount installation and pole-mount installation based on different installation environments.

Wall-mount Installation Figure 18 illustrates wall-mount installation.

FIGURE 18 ZXMBW E9230 WALL-MOUNT INSTALLATION
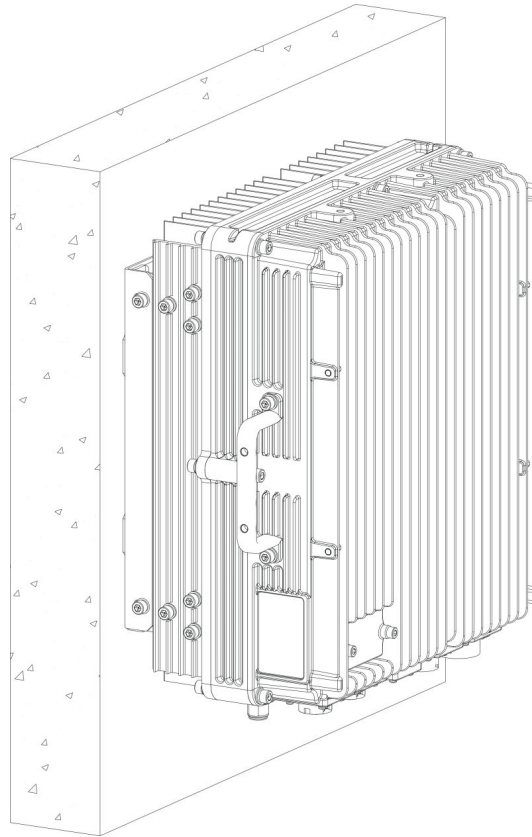
Pole-mount Installation The pole-mount installation is classified into three scenarios.

1. Pole-mount installation with one ZXMBW E9230 cabinet, as shown in Figure 19.

2. Pole-mount installation with two ZXMBW E9230 cabinets, as shown in Figure 20.

3. Pole-mount installation with three ZXMBW E9230 cabinets, as shown in Figure 21.

FIGURE 19 ONE ZXMBW E9230 POLE-MOUNT INSTALLATION
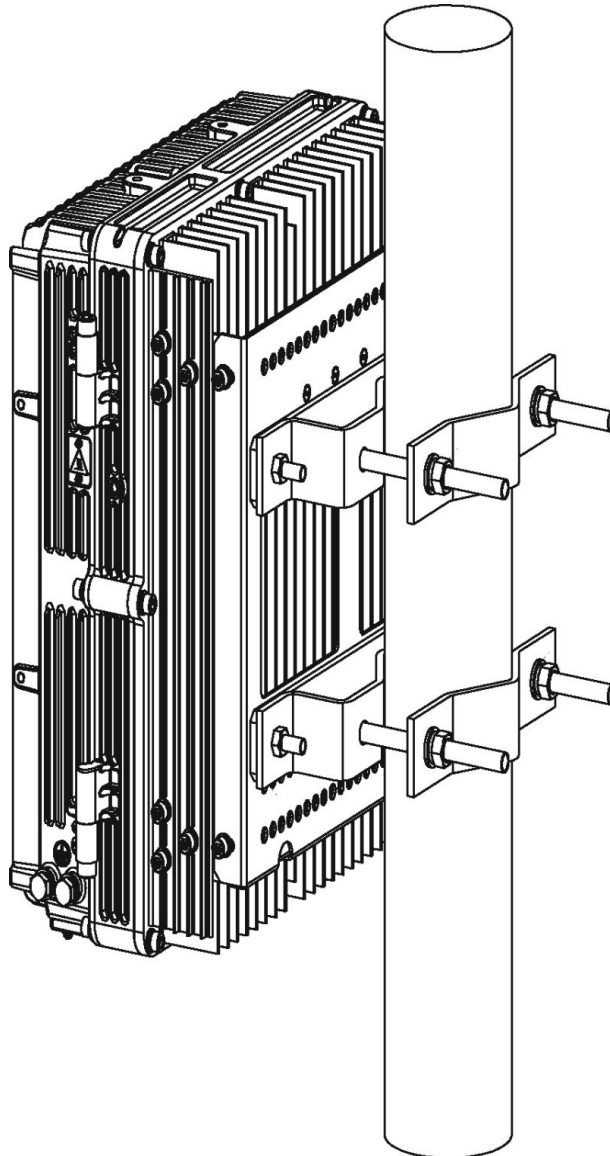
FIGURE 20 TWO ZXMBW E9230 POLE-MOUNT INSTALLATION
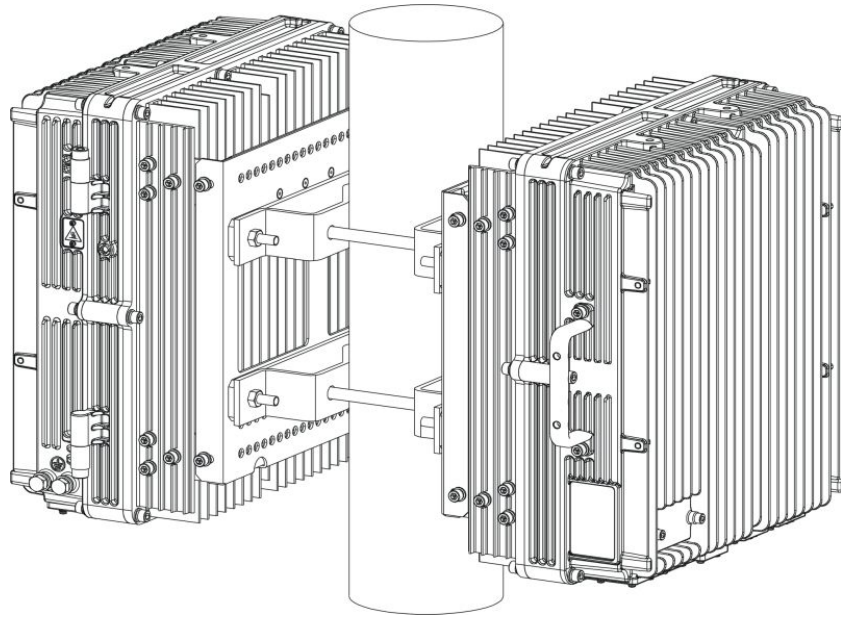
FIGURE 21 THREE ZXMBW E9230 POLE-MOUNT INSTALLATION
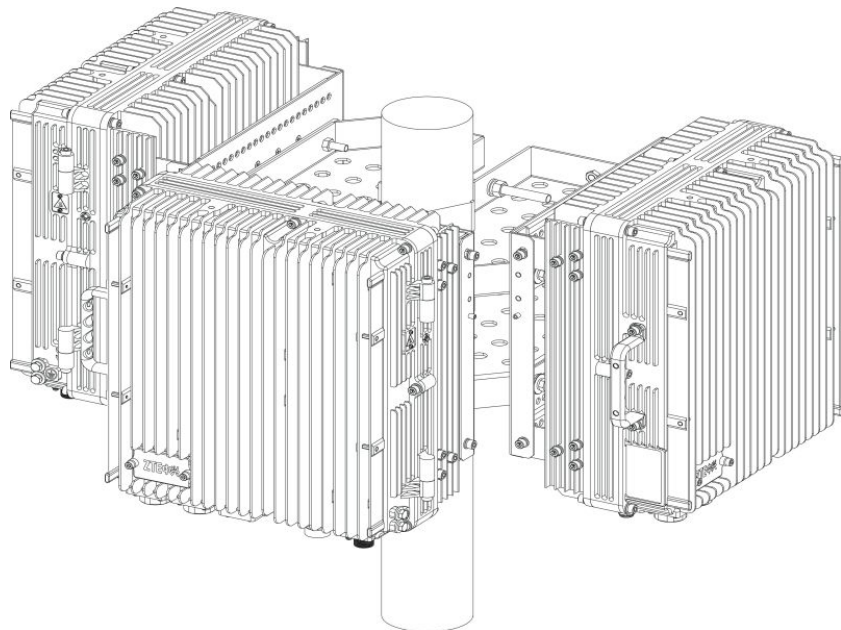
 Note:

For outdoor installation, install a sun shield. The sun shield is shown in Figure 22. For indoor installation, there is no need to install the sun shield.

FIGURE 22 SUN SHIELD
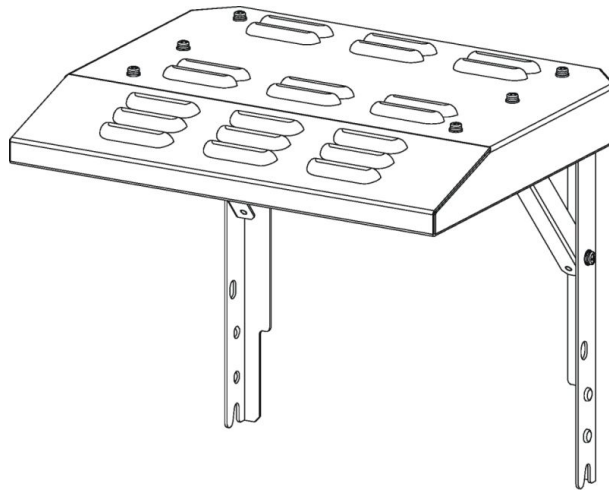
Installing a Wall-Mount Cabinet

Steps   1.   Mark hole positions.

Determine the positions on the wall for installing a ZXMBW E9230 according to the engineering design drawing. Then mark the hole positions on the wall with a hole design template. The hole template is shown in Figure 23.

FIGURE 23 HOLING TEMPLATE (UNIT MM)
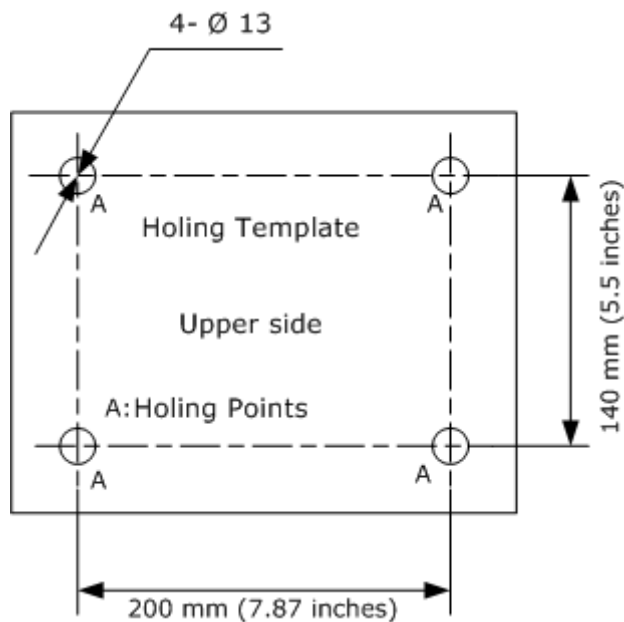
2.   Install M8×80 expansion bolts.

i.   Use an electrical percussion drill (φ10) to drill holes at these positions. Use a vacuum cleaner to clear dust while drilling.

ii. Lead an expansion tube through the expansion bolt and slightly tighten the nut. Insert them vertically into the hole and use a claw hammer to strike the expansion bolt into the hole. Screw down the nut to make the expansion tube expanded enough and then remove the nut, as shown in Figure 24.

FIGURE 24 INSTALLING M8×80 EXPANSION BOLT
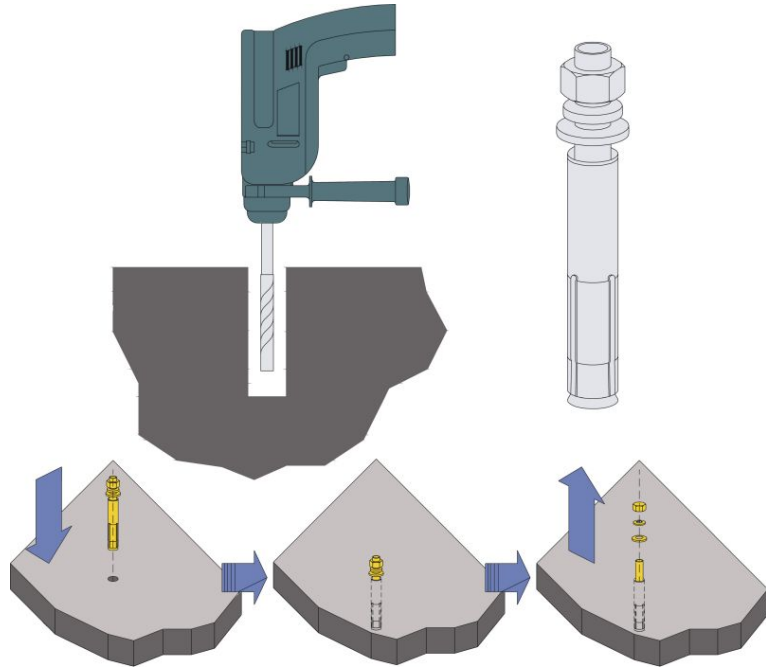
3. Install a supporting panel on the wall.

Fix the supporting panel on the wall with bolts as shown in Figure 25.

FIGURE 25 INSTALLING SUPPORTING PANEL ON WALL
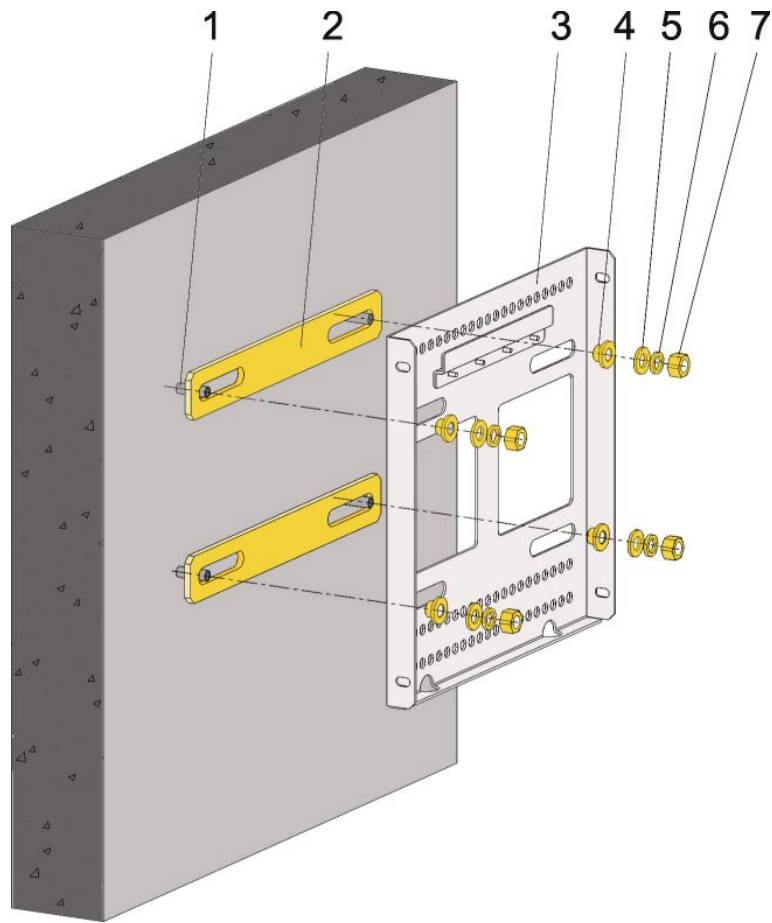
1.	M8×80 expansion bolt	5.	Plain washers
2.	Insulation board	6.	Spring mat
3.	Supporting panel	7.	M8 nut
4.	Insulation flange		

4. Install the ZXMBW E9230 cabinet.

   Mount the ZXMBW E9230 cabinet onto the supporting panel, and fasten them with four M6×20 hexagon socket cap screws as shown in Figure 26.

FIGURE 26 MOUNTING ZXMBW E9230 CABINET
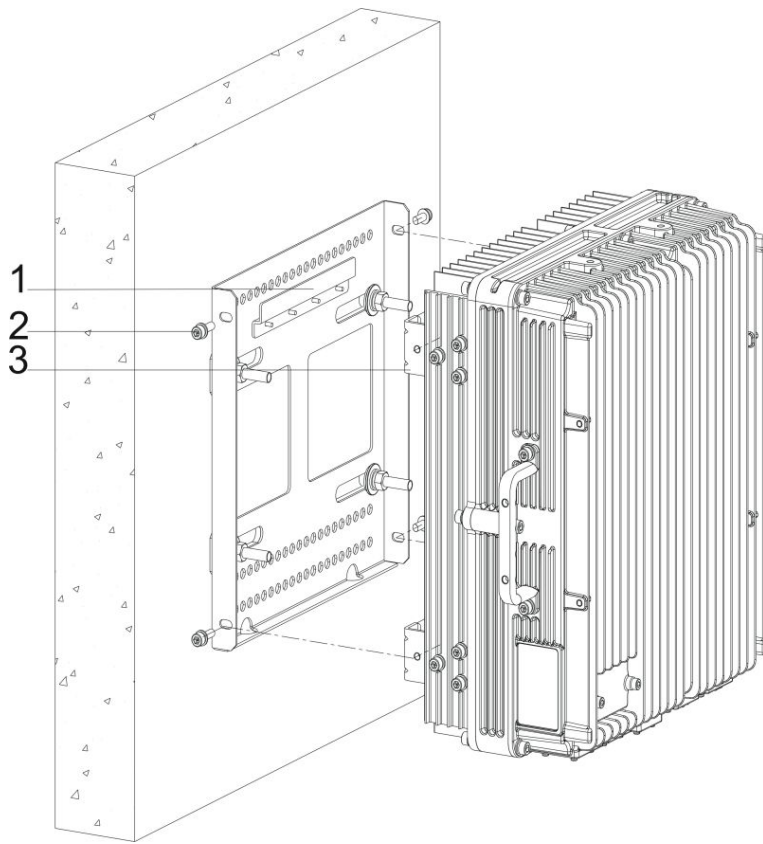
1.	Supporting panel	3.	Retaining board
2.	M6×20 Screw		

5. Install a sun shield (optional).

    i.   Assemble the sun shield with M5×16 cross recessed small pan head screws, as shown in Figure 27 and Figure 28.

FIGURE 27 ASSEMBLING SUN SHIELD (1)
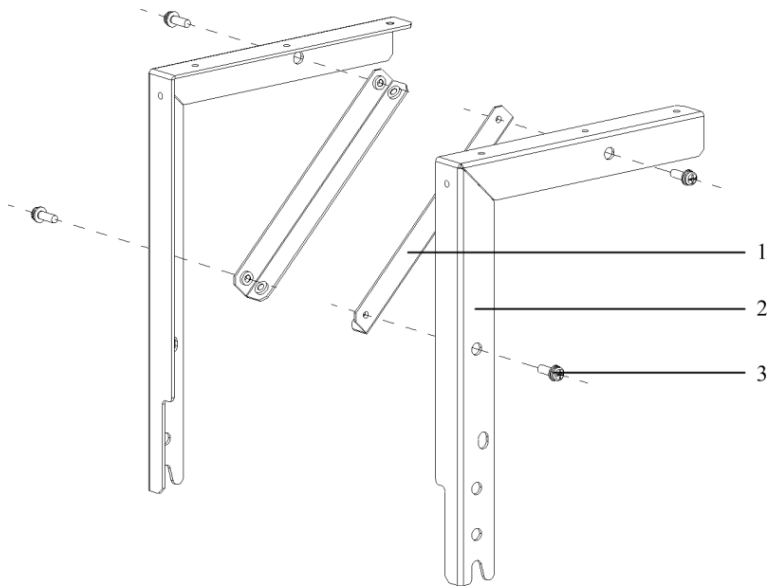
1. Reinforce rob
2. Bracket

3. M5×16 cross recessed small pan head screw
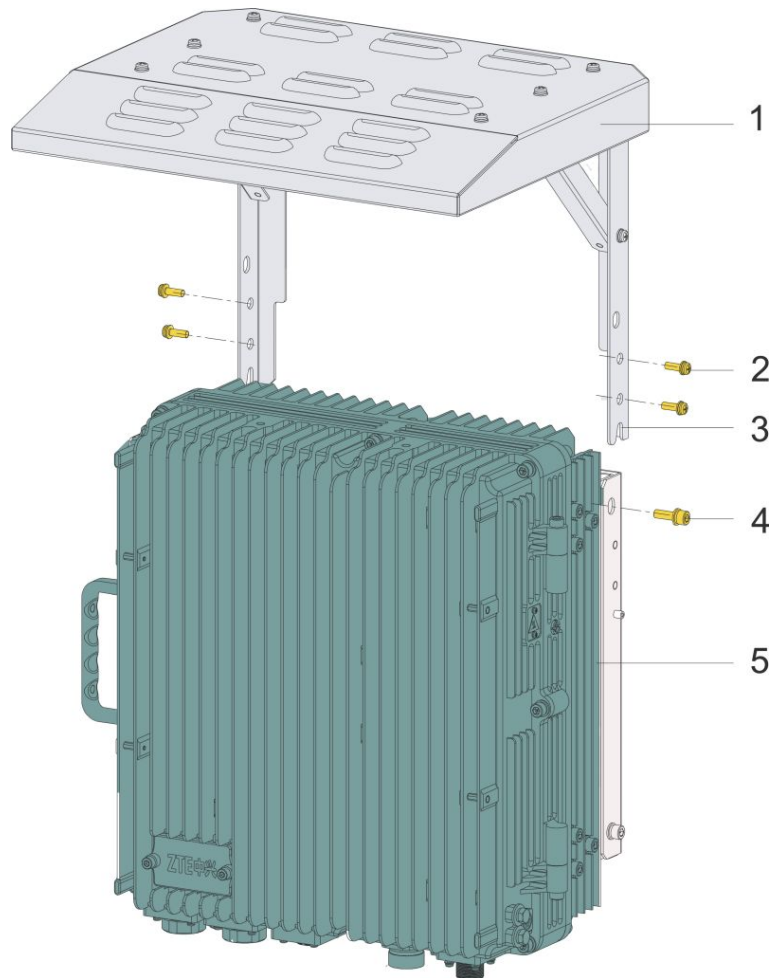
FIGURE 28 ASSEMBLING SUN SHIELD (2)
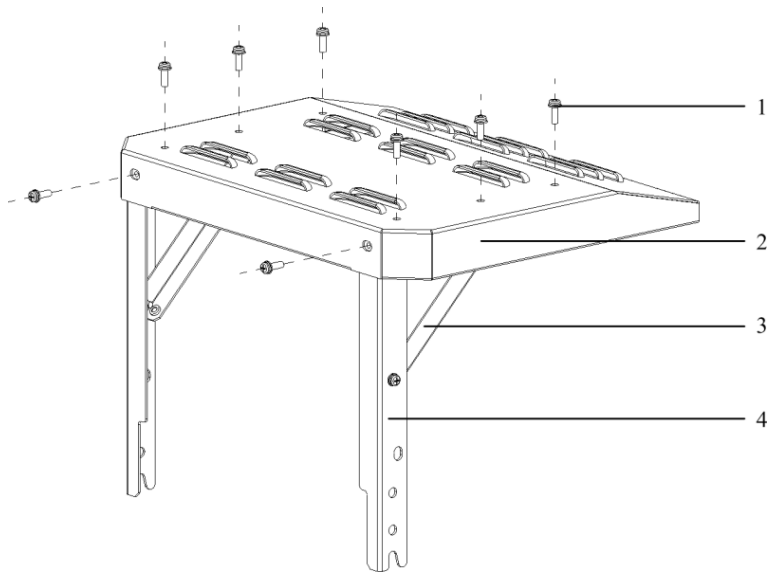
1. M5×16 cross recessed small pan head screw
2. Sun shield

3. Reinforce rob
4. Bracket

ii. Screw off two M6 screws at both sides of ZXMBW E9230 cabinet and fix the sun shield to the supporting panel.

iii. Mount the sun shield to the cabinet with two M6×20 hexagon screws and four M5×16 cross recessed small pan head combined screws, as shown in .

FIGURE 29 INSTALLING SUN SHIELD

1.	Sun shield	3.	Buckling position
2.	M5×16 cross recessed small pan head screw	4.	M6×20 hexagon screw
		5.	ZXMBW E9230 cabinet

END OF STEPS

Installing a Pole-Mount Cabinet

Steps   1. Mount supporting clip or fixing bracket assemblies .

For installing one or two ZXMBW E9230 cabinets, pre-install the clips to the pole, as shown in Figure 30.

For installing three ZXMBW E9230 cabinets, first pre-install two sets of fixing brackets to the pole, as shown in Figure 31.

FIGURE 30 MOUNTING CLIP ASSEMBLIES
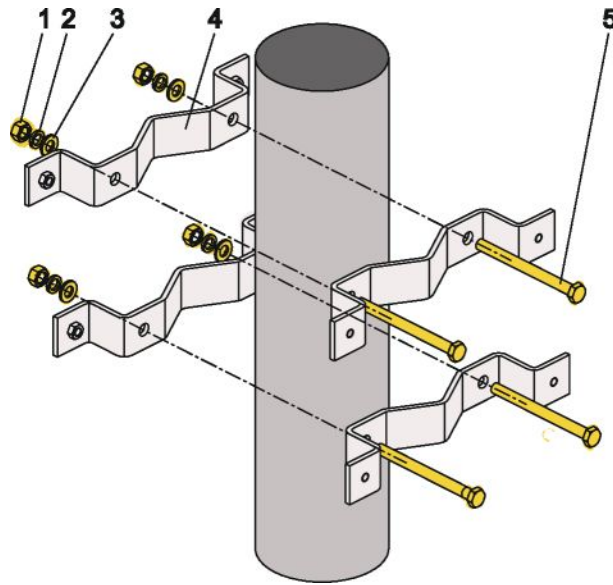
1. M10 nut
2. Spring washer 10
3. Big plain washer 10

4. Long clip
5. M10×120 (or M10×80) hexagon bolt

Note:

i. The pole should be made in the local. The suggested pole diameter is 60 to 120 mm (2.364.72 inches).

   – For installing one ZXMBW E9230 cabinet, it is recommended to use the pole with 75 mm diameter.

   – For installing two or three ZXMBW E9230 cabinets, it is recommended to use the pole with 100 to 120 mm diameter.

ii. There are two kinds of bolt length: 80 mm (3.15 inches) and 120 mm (4.72 inches) are available. and bolt of length 120 mm (5.12 inches) for pole diameter of 90 mm (3.54 inches)120 mm (4.72 inches).

   – Use the bolt of length 80 mm (3.15 inches) for pole diameter of 60 mm (2.36 inches)90 mm (3.54 inches).

   – Use the bolt of length 120 mm (5.12 inches) for pole diameter of 90 mm (3.54 inches)120 mm (4.72 inches).

FIGURE 31 MOUNTING FIXING BRACKET ASSEMBLIES
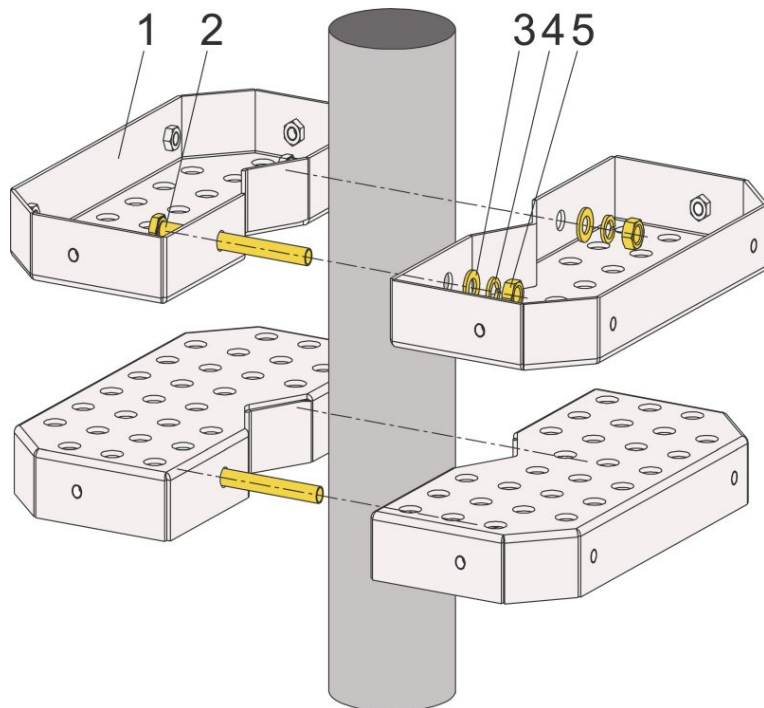
1.	Fixing bracket	4.	Plain washer 10
2.	M10×120 hexagon head bolt	5.	M10 hexagon nut
3.	Spring washer 10		

2. Mount the supporting panel assemblies.

For installing one ZXMBW E9230 cabinet, the supporting panel is installed as shown in Figure 32.

For installing two ZXMBW E9230 cabinets, the supporting panel is installed as shown in Figure 33.

For installing three ZXMBW E9230 cabinets, the supporting panel is installed as shown in Figure 34.

FIGURE 32 MOUNTING SUPPORTING PANEL (1)
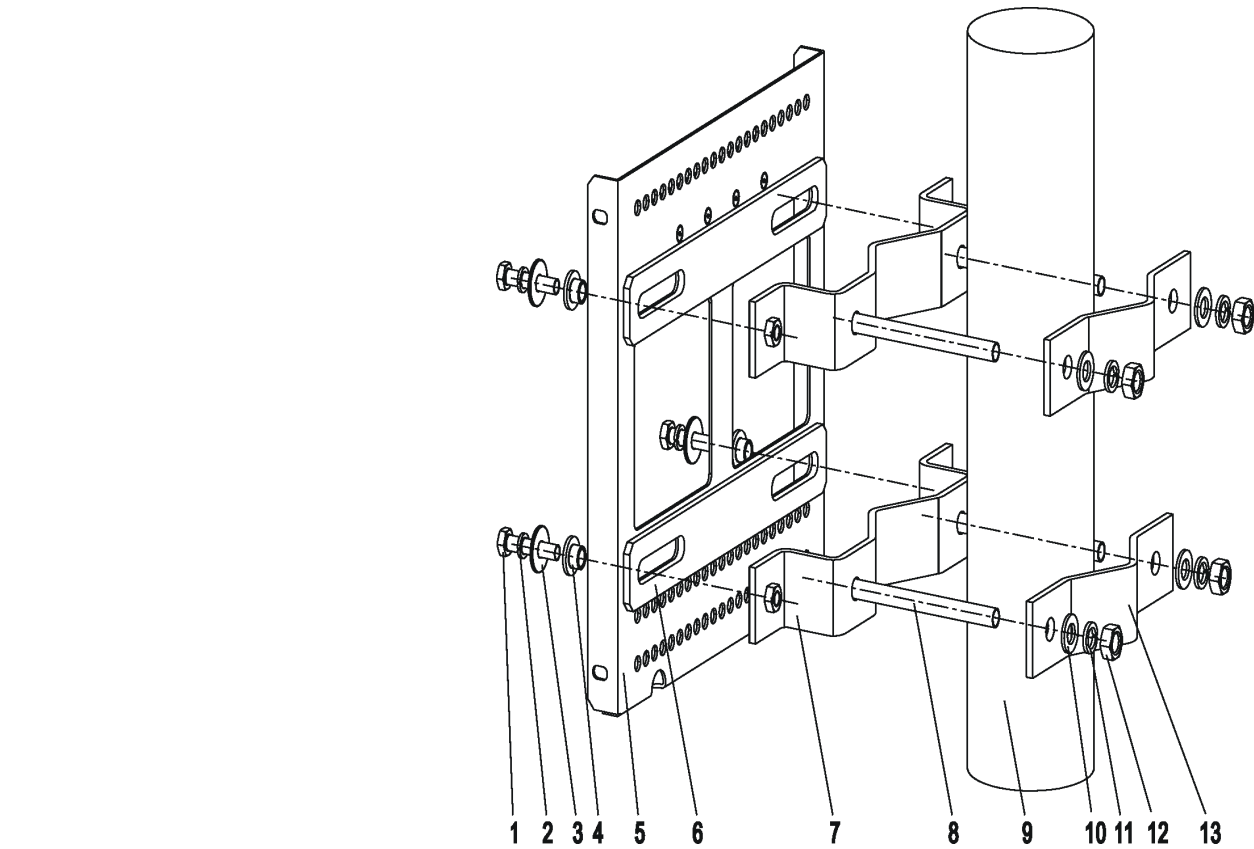
1. M8×40 hexagon head bolt
2. Spring washer 8
3. Big washer 8
4. Insulating flange
5. Supporting panel
6. Insulating plate
7. Long clip
8. M10×120   (or   M10×80)
   hexagon head bolt
9. Pole
10. Flat washer 10
11. Spring washer 10
12. M8 nut
13. Long clip

FIGURE 33 MOUNTING SUPPORTING PANEL (2)
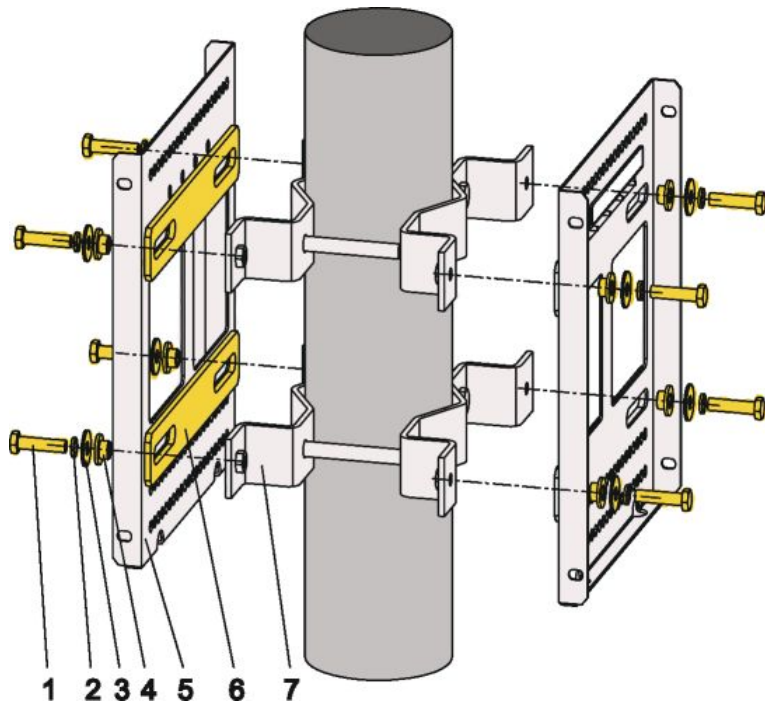
1. M8×40 hexagon head bolt	5. Supporting panel
2. Spring washer 8	6. Insulating plate
3. Big washer 8	7. Long clip
4. Insulating flange	

FIGURE 34 MOUNTING SUPPORTING PANEL (3)
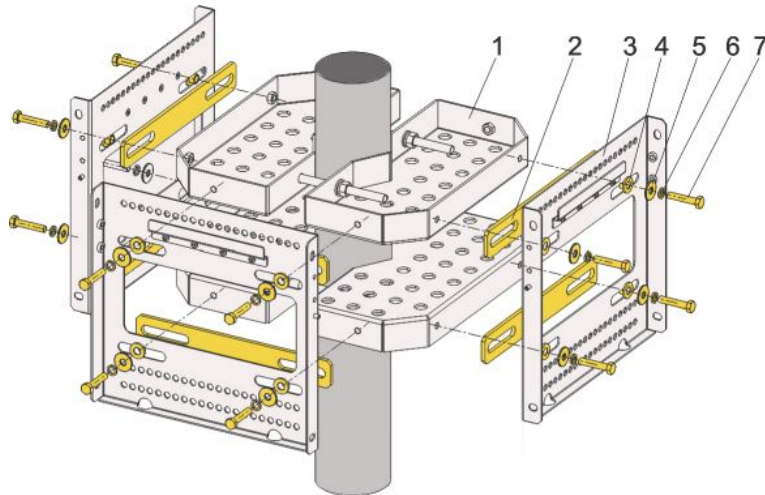
1. Fixing bracket	5. Big washer 8
2. Insulating plate	6. Spring washer 8
3. Supporting panel	7. M8×40 hexagon head bolt
4. Insulating flange	

3. Mount the ZXMBW E9230 cabinet.

   Hold the ZXMBW E9230 cabinet, align and fix its beam to the corresponding block plate on the supporting panel. Use M6×20

screws to fasten the cabinet and supporting panel, as shown in Figure 35, Figure 36, and Figure 37.

FIGURE 35 MOUNTING ONE ZXMBW E9230 CABINET
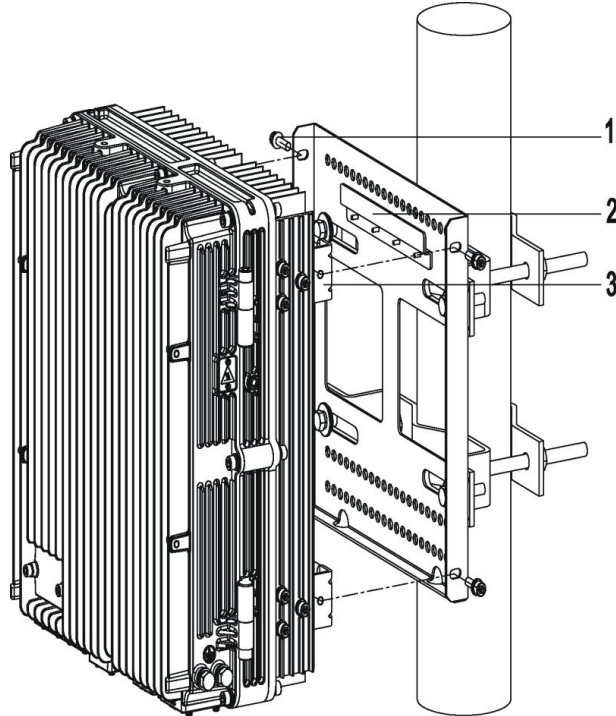
1. M6×20 hexagon head screw
2. Block plate on the supporting panel
3. Beam on the ZXMBW E9230 cabinet

FIGURE 36 MOUNTING TWO ZXMBW E9230 CABINETS
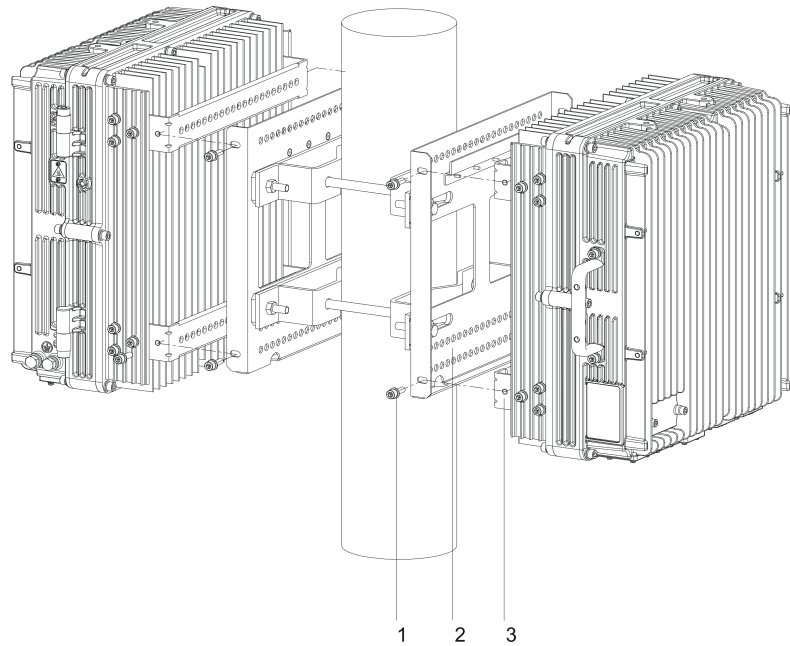
1. M6×20 hexagon head screw
2. Supporting panel
3. Beam on the ZXMBW E9230 cabinet

FIGURE 37 MOUNTING THREE ZXMBW E9230 CABINETS
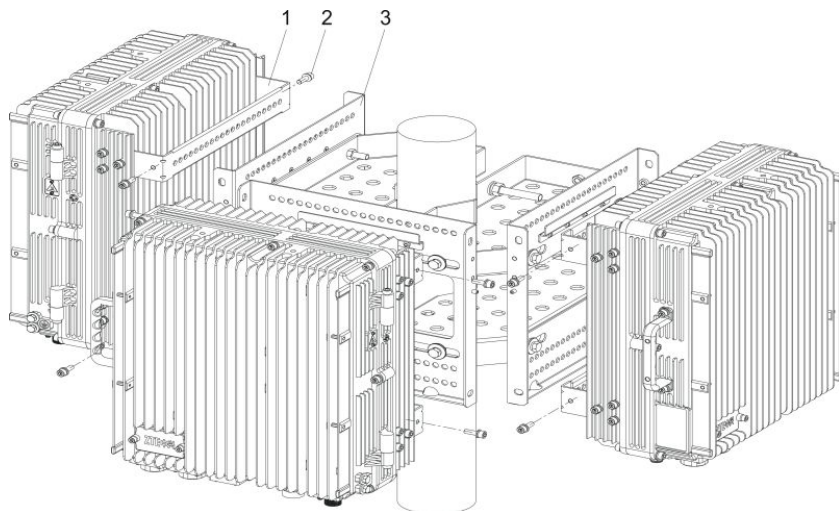
1. Beam on the ZXMBW E9230 cabinet
2. M6×20 hexagon head screw
3. Supporting panel

4. Install a sun shield (optional).

    i. Assemble the sun shield with M5×16 cross recessed small pan head screws, as shown in Figure 38 and Figure 39.

FIGURE 38 ASSEMBLING SUN SHIELD (1)
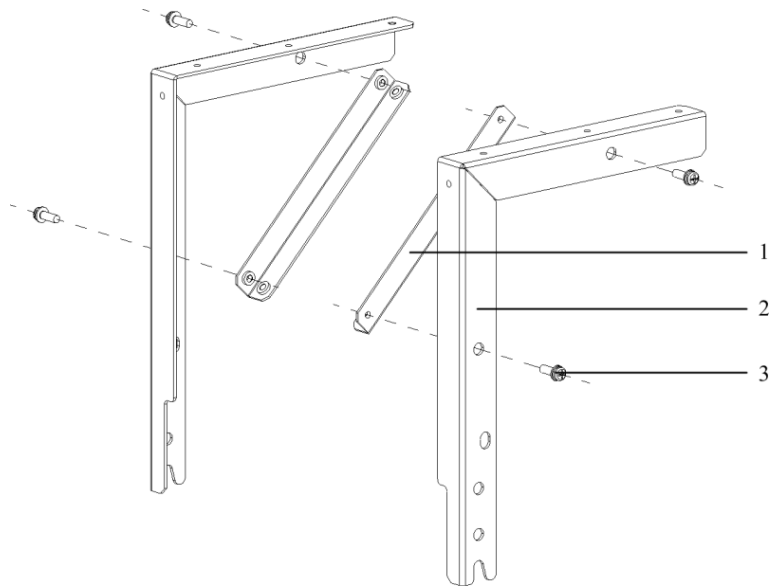
1. Reinforce rob
2. Bracket

3. M5×16 cross recessed small pan head screw

FIGURE 39 ASSEMBLING SUN SHIELD (2)
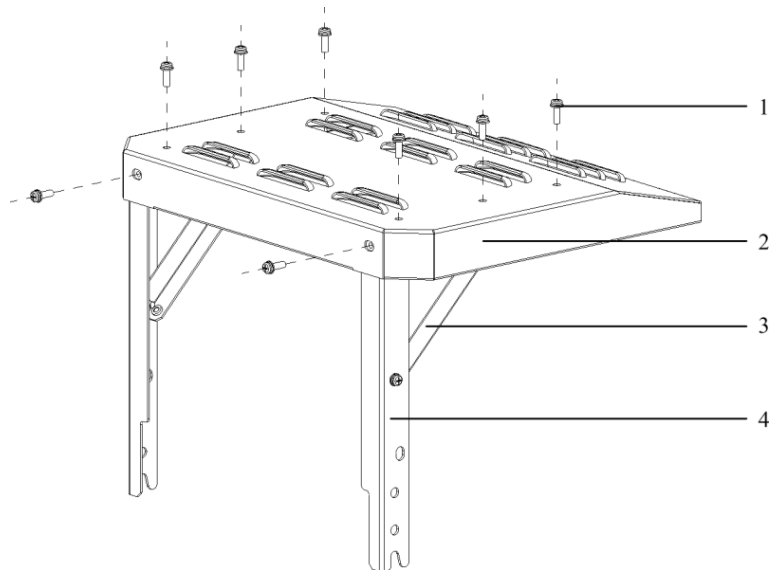
1. M5×16 cross recessed small pan head screw
2. Sun shield

3. Reinforce rob
4. Bracket

ii. Screw off two M6 screws at both sides of ZXMBW E9230 cabinet and fix the sun shield to the supporting panel.

iii. Mount the sun shield to the cabinet with two M6×20 hexagon screws and four M5×16 cross recessed small pan head combined screws, as shown in Figure 40.

FIGURE 40 INSTALLING SUN SHIELD

1.	Sun shield	3.	Buckling position
2.	M5×16 cross recessed small pan head screw	4.	M6×20 hexagon screw
		5.	ZXMBW E9230 cabinet

END OF STEPS

Installing External Cables

Installing Power Cable

Context   ZXMBW E9230 cabinet uses -48 V DC for power supply.

Table 14 describes power cable configuration.

TABLE 14 POWER CABLE CONFIGURATION

Cable Type	Maxi-mum Us-age Dis-tance	Recom-mended Usage Dis-tance	Note
4–core DC power cable, 1.5mm² per core	80 m	Within 60 m	-48V and -48 GND respectively use two cores
2–core DC power cable, 6mm² per core	150 m	Within 80 m	-48V and -48 GND respectively use one core

DC Power Cable

1. One end of DC power cable is a type of aviation connector (four-core) and the other end is reserved for engineering. The length of cable that is made on site is based on the engineering survey. The structure of DC power cable is as shown in Figure 41.

FIGURE 41 DC POWER CABLE STRUCTURE
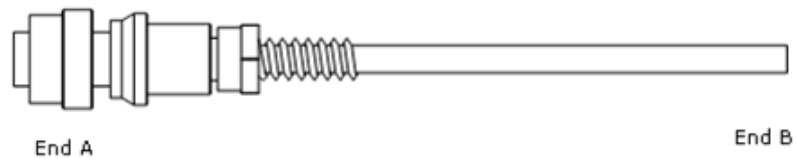
2. Table 15 describes core color and definition inside the DC power cable.

TABLE 15 DC POWER CABLE INNER CORE COLOR AND DEFINITION

Color	Definition
Blue	-48V
Black	-48V GND

ⓘ **Note:**

i. Using two-core cable, the blue core stands for -48V and the black core stands for -48V GND.

ii. For four-core cable, the two-link blue cores combined stand for -48V and two-link black cores combined stand for -48V GND.

Steps 1. Connect End A of power cable to a power interface of ZXMBW E9230 cabinet (DC power cable is connected to DC IN inter-face).

2. Strip off a protective sheath of End B and connect to relevant power devices according to the core colors.

3. Bind and fasten the power cable at 0.5 m off the lower connector.

4. Perform waterproof processing for the aviation connector.

5. Affix a label with fasteners at two ends of power cable.

END OF STEPS

Installing Grounding Cable

Prerequisites
1. Install the ZXMBW E9230 cabinet.

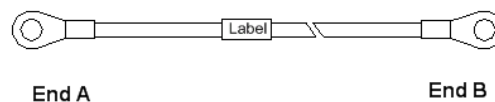2. Install the grounding copper bar.

3. Measure the grounding resistance (≤10Ω).

Context
1. The grounding cable is made of fireproof multi-strand conductors. It is in yellow and green and its cross sectional area is 16mm^2, as shown in Figure 42.

FIGURE 42 GROUNDING CABLE

Steps
1. Copper lugs are crimped at both ends of the grounding cable, as shown in Figure 43.

**FIGURE 43 CRIMPING COPPER LUGS**

End A   End B

> **ⓘ Note:**
>
> The grounding cable length that connects the ZXMBW E9230 cabinet with the grounding copper bar should be less than 2 m.

2. Connect the copper lug at the end of grounding cable to the grounding screw of ZXMBW E9230 cabinet. Screw down the grounding screw.

3. The cooper bar of ground net is as shown in Figure 44. Clear off rust on the copper bar and then connect the other end of grounding cable to the copper bar. Finally, fix them with a bolt.

FIGURE 44 COPPER BAR OF GROUND NET
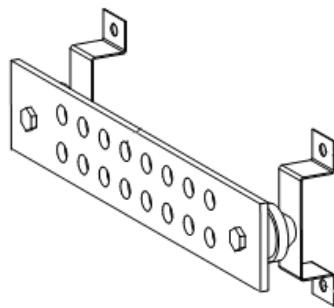
4. Cover antirust lacquer around the bolt.

5. Affix a label on the grounding cable.

**END OF STEPS**

Installing RF Jumper

Context RF jumper is used to connect the main feeder and the antenna feeder interface of ZXMBW E9230. Its installation is supposed to be after that of the main feeder.

The RF jumper adopts the finished 1/2" jumper with 2 m long. It can also be made at fieldwork according to the practical condition.

Figure 45 shows the installation position of RF jumper.

FIGURE 45 RF JUMPER INSTALLATION POSITION
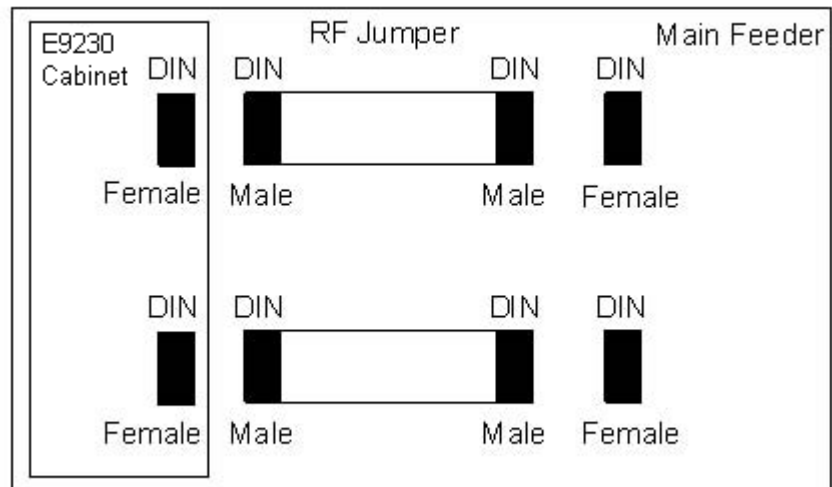
Steps   1. Connect the DIN connector (male) of the RF jumper to the DIN connector (female) of main feeder.

2. Connect the N connector (male) of the RF jumper to the RF antenna port (port 0/1) of ZXMBW E9230 cabinet.

3. Perform waterproof processing on the connectors, as shown in Performing Outdoor-connector Waterproof Processing.

END OF STEPS

Installing Antenna

Context   Technical parameters involved in antenna installation:

1. Antenna height: Determined by the network plan.

2. Antenna azimuth: Determined by the network plan.

3. Antenna pitch angle: Determined by the network plan, usually adjustable between 0° to 10°.

4. Antenna directional angle: Determined by the antenna azimuth. The directional angles of the two antennas of one sector must be the same.

The antenna installation position must be in accordance with project design. If the installation position needs any modification, the project supervisor must negotiate with operator's representative.

The antenna installation position needs to take care fore lightning protection as shown in Figure 46.

FIGURE 46 ANTENNA INSTALLATION POSITION
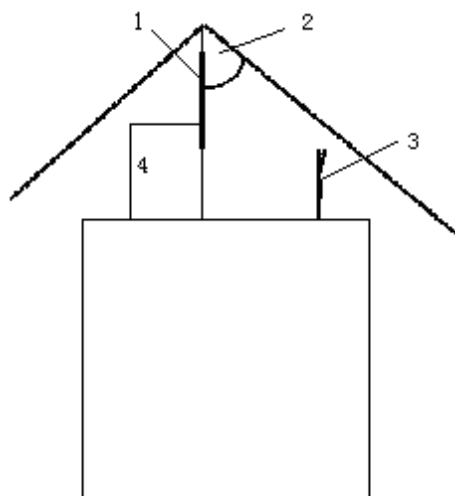
1. Lightning rod	3. Antenna
2. 45° Lightning protection area	4. Grounding cable

Following are lightning protection requirements to install an antenna:

- The antenna should be installed with in 45° coverage area of lightning rod.

- If there is no special lightning protection arrangement like the above, install the lightning protection system onto the antenna pole.

- Make sure that the lightning rod is well grounded.

Note:

This section introduces the installation process of directional antenna. Refer to the installation guide delivered with the antenna for detailed installation steps.
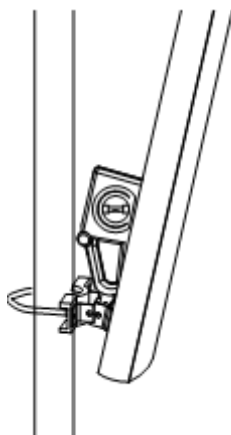
Steps

1. Assemble parts of directional antenna.

   Firstly assemble fastener "C" onto the upper and lower ends of antenna as shown in Figure 47. Then mount fasteners "B" and "A" to complete the initial installation of the directional antenna.

FIGURE 47 DIRECTIONAL ANTENNA INSTALLATION
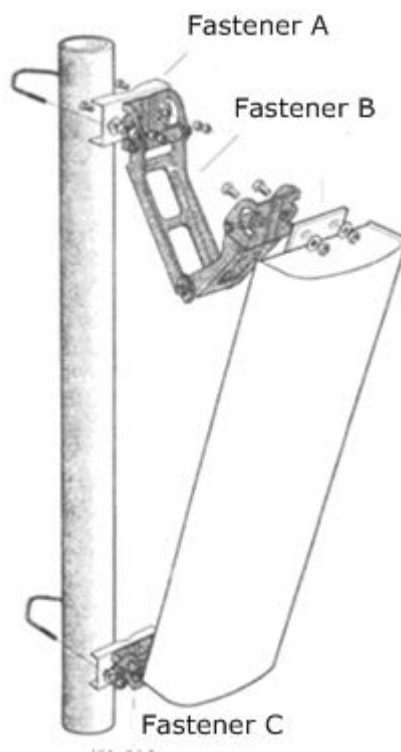
2. Fix the directional antenna to the pole.

   Attach the antenna along with fixtures onto the pole. Do not tighten the screws too tightly to allow easy adjustment of the direction and downtilt of the antenna. However, degree of tightness must be appropriate enough to ensure that the antenna does not slid downward.

3. Adjust the antenna's azimuth.

   i. Determine the azimuth of the antenna by using a compass, and determine the installation direction according to the engineering design drawing.

   ii. Turn the antenna slightly to adjust it's face direction as shown in Figure 47. At the same time, measure the direction of the antenna with a compass until the error comes within the engineering design requirements (generally not more than 5°).

   iii. After adjusting the azimuth of the antenna, tighten the fastener "A".

4. Adjust the antenna's downtilt.

   i. Adjust the downtilt of the measurement meter to obtain the required angle according to the engineering design.

   ii. Turn the top of the antenna slightly, and loose or fast the antenna at its top. Adjust the downtilt angle of the antenna till the measurement meter's bubble comes to be centered as shown in Figure 48.

FIGURE 48 ANTENNA DOWNTILT ADJUSTMENT

iii. After adjusting the downtilt of the antenna, tighten the fastener "B.

END OF STEPS

Installing Feeder Grounding Kit

Prerequisites
- Install the feeder.
- Prepare required tools including paper knife, flat head screwdrivers, and wrench and sharp-nose pliers.

Steps
1. Peel off 7/8" sheath according to size of grounding clip at the positions. Figure 49 illustrates structure of grounding kit.

FIGURE 49 GROUNDING KIT STRUCTURE
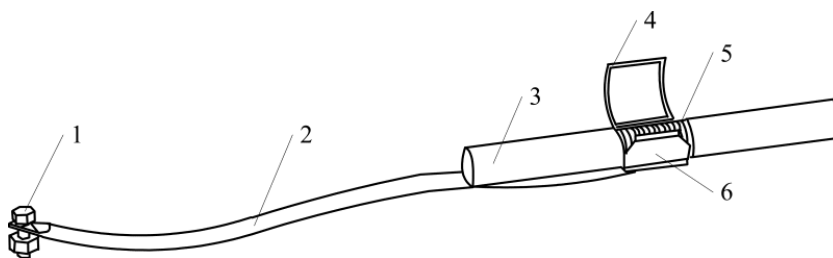
1. Grounding terminal	4. Grounding spring lock
2. Grounding cable	5. Feeder external copper core
3. Feeder cable	6. Grounding cable copper piece

2. Lay the grounding cable facing to the ground network. Avoid bending or folding. And keep the included angel between grounding cable and feeder cable less than 15°.

i. While installing the antenna feeder system on a tower, make sure the ground cable of grounding kit downwards along the tower.

ii. While installing the antenna feeder system atop a building, lead the ground cable of grounding kit towards a lightning net.

3. Before installing the grounding kit, in order to enhance sealing effect and avoid water into feeder inner along the ground cable, first wrap waterproof self-adhesive tape round the ground cable close to a copper sheet, as shown in Figure 50.

FIGURE 50 WRAPPING WATERPROOF ADHESIVE TAPE

4. Clamp an outer conductor of feeder with a copper sheet of ground cable and a snap spring and make the copper sheet combined with the outer conductor.

5. Perform waterproof and sealed processing for junction between ground kit and feeder. The methods are listed as follows:

i. First wrap waterproof self-adhesive tape and then wrap PVC adhesive tape.

ii. For waterproof self-adhesive tape, first wrap from lower to upper layer by layer, then wrap from upper to lower layer by layer, and finally wrap from lower to upper layer by layer. During wrapping, the former layer covers a half of the next layer.

6. The grounding terminal of ground kit can be connected to a body of tower or a cable tray on the top of building. . While connecting, remove the paint and oxide at connection place within a radius of 13 mm (8/16 inches) around the joint, and daub the place with antioxidant cream to ensure good electric contact. After connecting, paint the joint with anticorrosive paint.

END OF STEPS

Performing Outdoor-connector Waterproof Processing

Context   The waterproof processing for outdoor connectors adopts the "1+3+3" mode to warp "one layer PVC insulating tape + three

layer waterproof insulating tape + three layer PVC insulating tape".

The waterproof insulating tape is as shown in Figure 51.

FIGURE 51 WATERPROOF INSULATING TAPE

The PVC adhesive tape is as shown in Figure 52, used to protect connectors from damage as well as waterproof tape from aging.

FIGURE 52 PVC ADHESIVE TAPE

Steps   1. Wrap a layer of PVC insulating tape.

   i.   Clean out dust and stain on the feeder connector or feeder grounding kit.

   ii. As shown in Figure 53, wrap the feeder with the PVC insulating tape in an overlapping way from lower to upper, and the upper adhesive tape should cover a half of the lower adhesive tape. The extended width of adhesive tape is not over 1/2 longer than the former width, or else it destroys molecular structure of adhesive tape due to extension too much.

FIGURE 53 WRAPPING A LAYER OF PVC INSULATING TAPE

2. Wrap three layers of waterproof insulating tape.

    i. Expand the waterproof insulating tape and strip off release paper. The adhesive tape sticks to the connector or the feeder which is 20~50 mm away from the lower end of grounding kit.

    ii. Extend the adhesive tape to up to 1/2 – 3/4 of the former width, in order to keep a certain extension strength. Bind the feeder in an overlapping way from lower to upper, and the upper adhesive tape should cover a half of the lower adhesive tape, as shown in Figure 54.

FIGURE 54 WRAPPING THREE LAYERS OF WATER INSULATING TAPE (THE FIRST LAYER)

 Note:

The wrapping direction should be towards the direction of connector screwed down. Prohibit wrapping in a reverse direction.

    iii. While wrapping to the 20~50 mm position off the connector , repeat it for twice and the sequence respectively is: from upper to lower as shown in Figure 55 and from lower to upper as shown in Figure 56.

FIGURE 55 WRAPPING THREE LAYERS OF WATER INSULATING TAPE (THE SECOND LAYER)

FIGURE 56 WRAPPING THREE LAYERS OF WATER INSULATING TAPE (THE THIRD LAYER)

iv. After wrapping the waterproof insulating tape, press the adhesive tape at the binding with hands and make it affixed tightly.

3. Wrap three layer of PVC insulating tape.

   Two ends of PVC insulating tape must be 20mm longer than the upper layer of waterproof insulating tape. Bind the feeder in an overlapping way from lower to upper, and the upper adhesive tape should cover a half of the lower adhesive tape, as shown in Figure 57. Repeat it for twice and the sequence respectively is: from upper to lower as shown in Figure 58 and from lower to upper as shown in Figure 59. Make sure proper stretch strength during wrapping.

FIGURE 57 WRAPPING THREE LAYERS OF PVC INSULATING TAPE (THE FIRST LAYER)

FIGURE 58 WRAPPING THREE LAYERS OF PVC INSULATING TAPE (THE SECOND LAYER)

FIGURE 59 WRAPPING THREE LAYERS OF PVC INSULATING TAPE (THE THIRD LAYER)

4. After finishing wrapping, fasten two wrapped ends with black fasteners, as shown in Figure 60.

FIGURE 60 FASTENING

END OF STEPS

VSWR Test

Steps

1. After the installation of all antenna feeders and jumpers, conduct the VSWR test. The VSWR must be less than 1.5.

2. If the VSWR is more than 1.5, check the main antenna and feeder system, that is:

   ▸ Check whether the antenna feeders, connectors, and jumpers are intact.

   ▸ Ensure that the connection between all parts are proper.

   ▸ Check whether the antenna feeder installation is perfect.

END OF STEPS

Cabinet Installation Check

Cabinet Installation Check

1. Ensure that cabinet installation location complies with the engineering design drawing.

2. Erect cabinet firmly so as to resist an earthquake measuring up to 7.0 on Richter scale.

3. Ensure that horizontal and vertical error, and the gap between adjacent bases are less than 3 mm.

4. Ensure that cabinet surface is clean and tidy and covered well by oil paint. All parts of the cabinet are completed and all markings on the cabinet are correct, clear and complete.

On-site Environment Inspection Items

Check whether redundant goods on site are cleared out and make sure no binding tape, waste carton, waste cable and plastic bag left.

Make sure that the installation site is neat and tidy.

Power-on

Prerequisites
1. Power supply voltage accords with ZXMBW E9230 requirements.

2. Connect the cabinet power and grounding cable properly.

3. The power switch is disconnected.

Steps
1. There is no power switch located at the ZXMBW E9230 cabinet. Therefore, opening external power switches will power on ZXMBW E9230.

2. During power-on process, if abnormal phenomenon occurs, disconnect the power switch immediately and find the source of problem.

END OF STEPS

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Figures

Tables