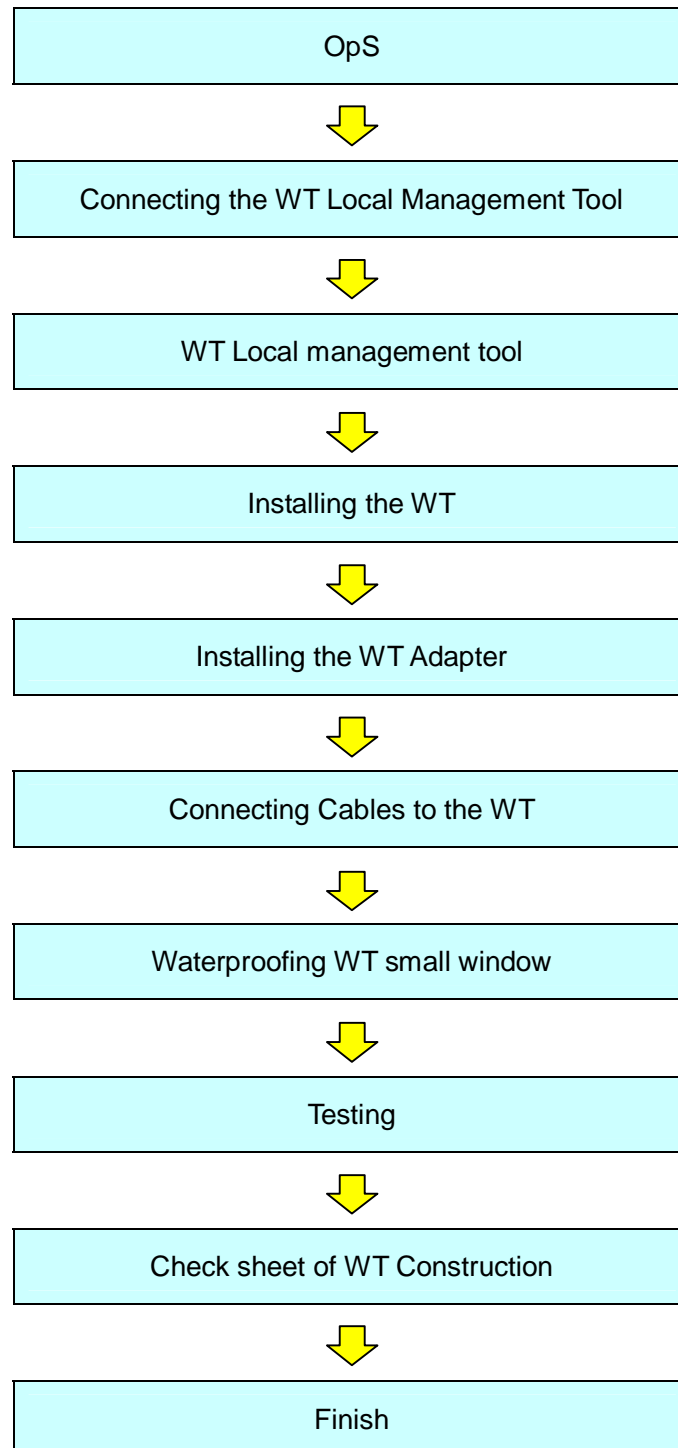


6. CONSTRUCTING A POINT-TO-MULTIPOINT SYSTEM (WT)

6.1. Overview



6.2. OpS

6.2.1. Register the WT ID number to AP

Connect the OpS to the target AP and register a WT.

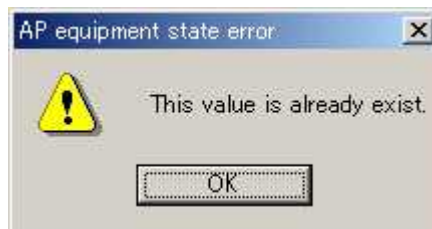
Step 1: In the OpS, select the WT Parameter Setup/Control tab.

Step 2: Select the WT from "Select WT ID number."

Step 3: Specify the setup parameters.

- VLAN-TAG Cont: Set the VLAN-TAG Cont to Transparent.
- Authen Param: Set the authentication parameter.
- Serial number: Set the serial number and click the **Set** button.
- WT Reg. Status: Set the WT registration status to Registered and click the **Set** button.
- Modulation: Set the modulation to QPSK, 16QAM, or Adaptive and click the **Set** button.
- Interface Class: Set the interface class to AUTO or 10BASE and click the **Set** button.
- RFU Transmission: Set the RFU Transmission to Enable and click the **Execute** button.

The following dialog box appears since a value is already set for "RFU Transmission." Click the **OK** button.



- UP Stream Bandwidth table [Maximum Limit / Minimum Guarantee]
- Down Stream Bandwidth table [Maximum Limit / Minimum Guarantee]

Clicking the **Set** button displays a dialog box. Place checkmarks in the checkboxes and click the **Set** button.

Step 4: Set the VLAN-ID.

- VLAN-ID: Set the VLAN-ID and click the **Register** button.
- Since the VLAN-ID that has been set appears on the screen, select it.
- VLAN-ID Registration status: Set the VLAN-ID registration status to Registered.
- Service status [out of service / In service] : Set the Service status to In service

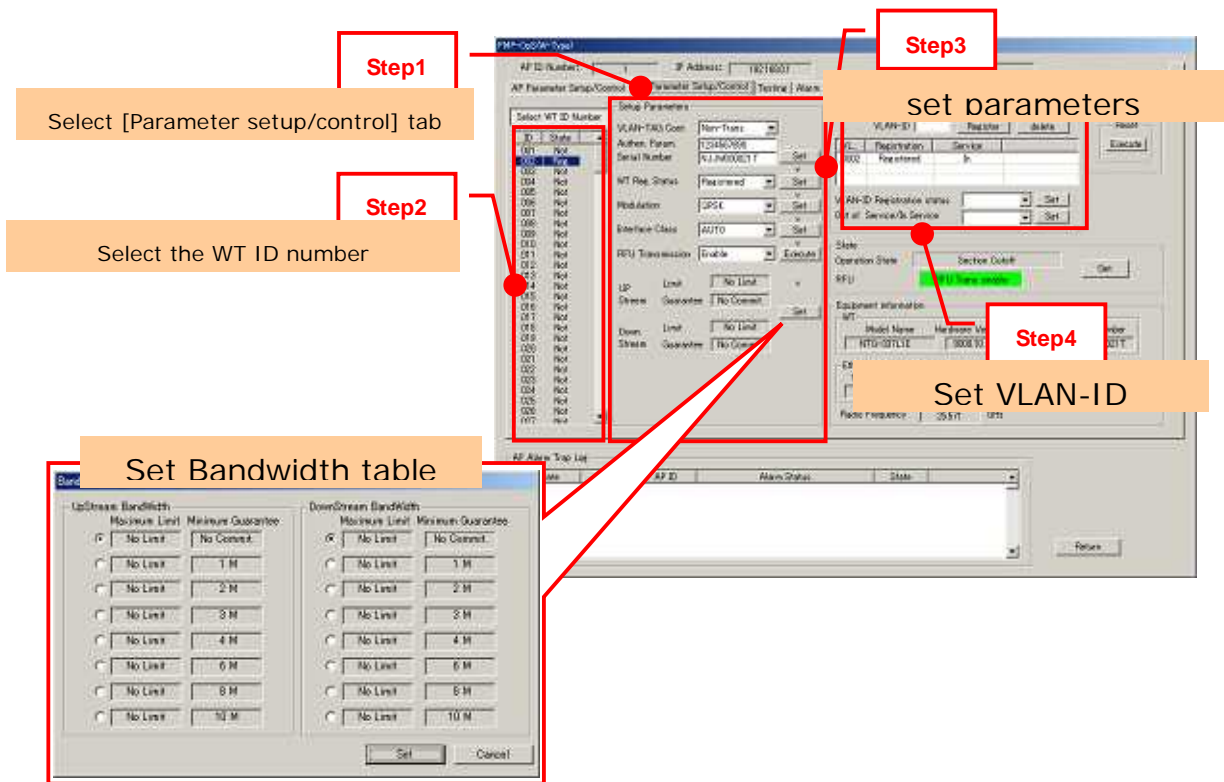


Figure 6-1 Register the WT ID number to AP

6.3. Connecting the WT Local Management Tool

Connect the WT local management tool terminal to the PC port of the WT adapter (Figure 6-2) using a straight Ethernet cable.

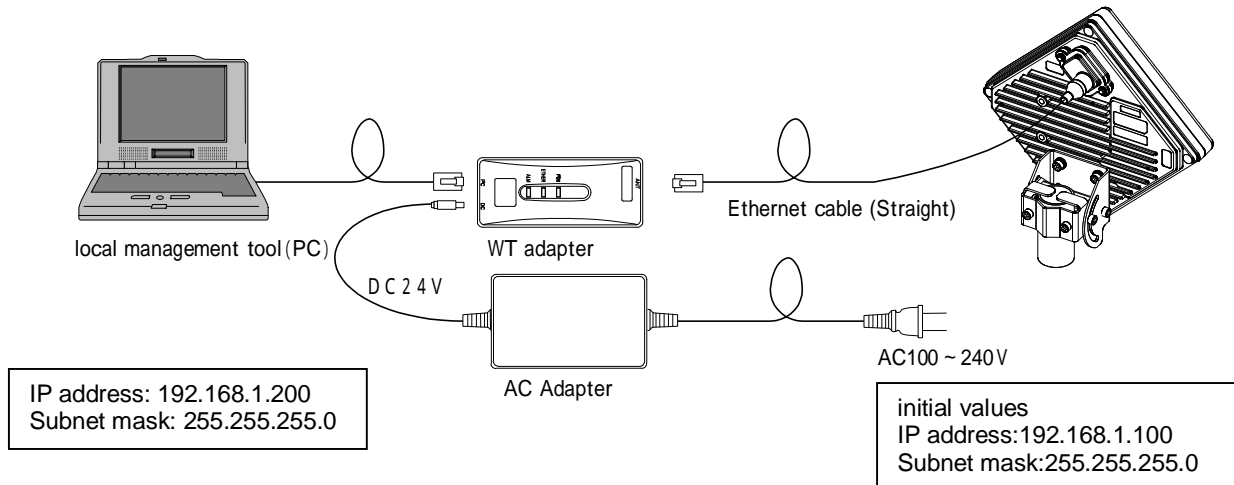


Figure 6-2 Connection

6.4. WT Local management tool

6.4.1. Configure the WT

Use the WT Local Management Tool to specify the Setup Parameters.

- Step 1: Select the Setup tab.
- Step 2: Set the WT ID number.
- Step 3: Set the AP ID number.
- Step 4: Set the authentication parameter.
- Step 5: Set the radio frequency.
- Step 6: Click the **Setup** button.

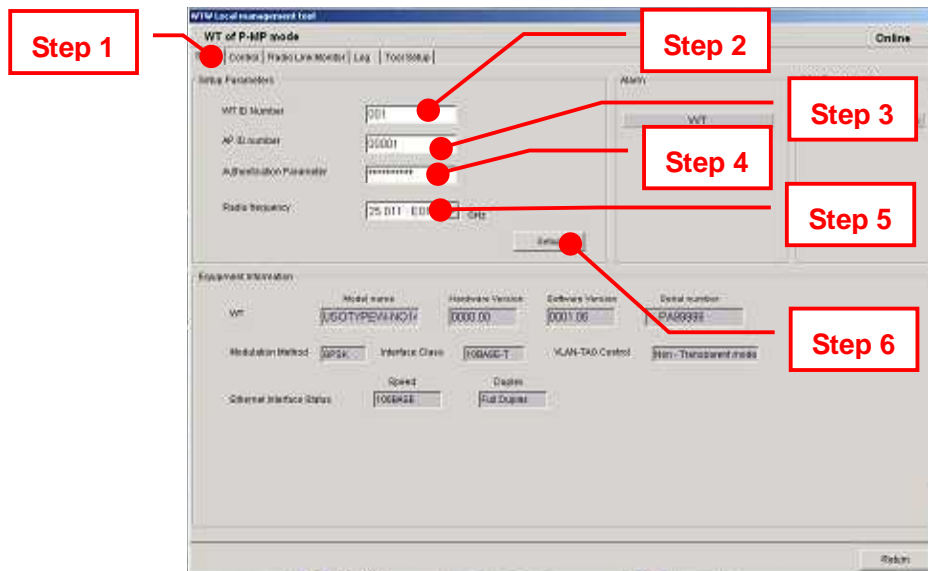


Figure 6-3 Configure the WT

6.5. Installing the WT

6.5.1. Installing the WT

Step1 Attach the WT mounting bracket to the WT using the bolts(a)and (b).

You can orient the WT either for vertical or horizontal polarization.

Step2 Secure the WT mounting bracket to the pole using the bolts.

Applicable pole diameter: From $\Phi 31.8\text{mm}$ to $\Phi 34\text{mm}$

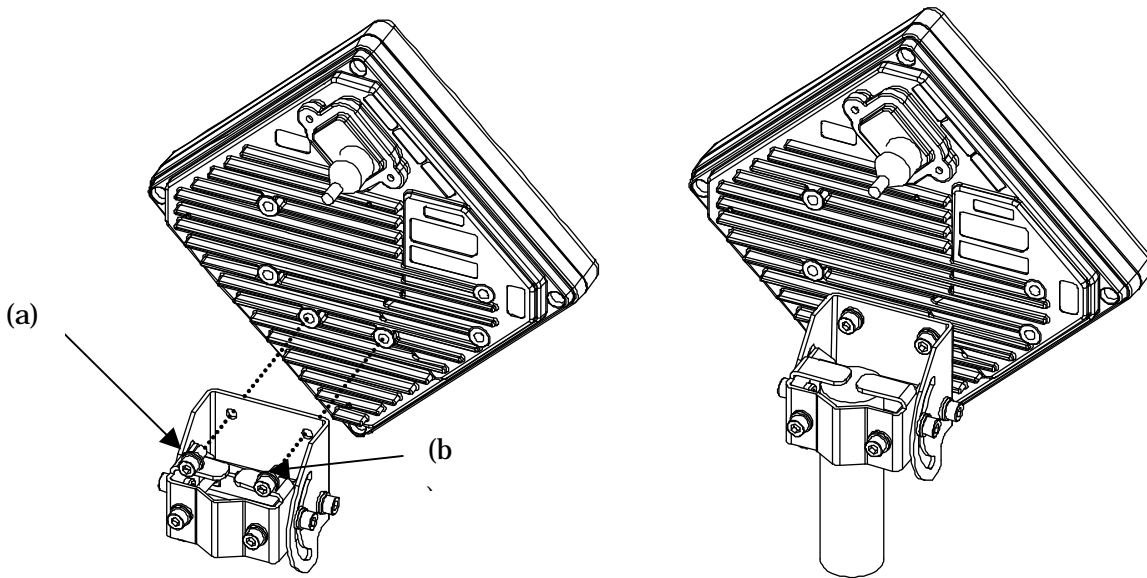


Figure 6-4 Installing the WT

A builder prepares a steel pipe by the installation place (a wall, a pole or etc.), and it install.
 The required space of installation is shown below.

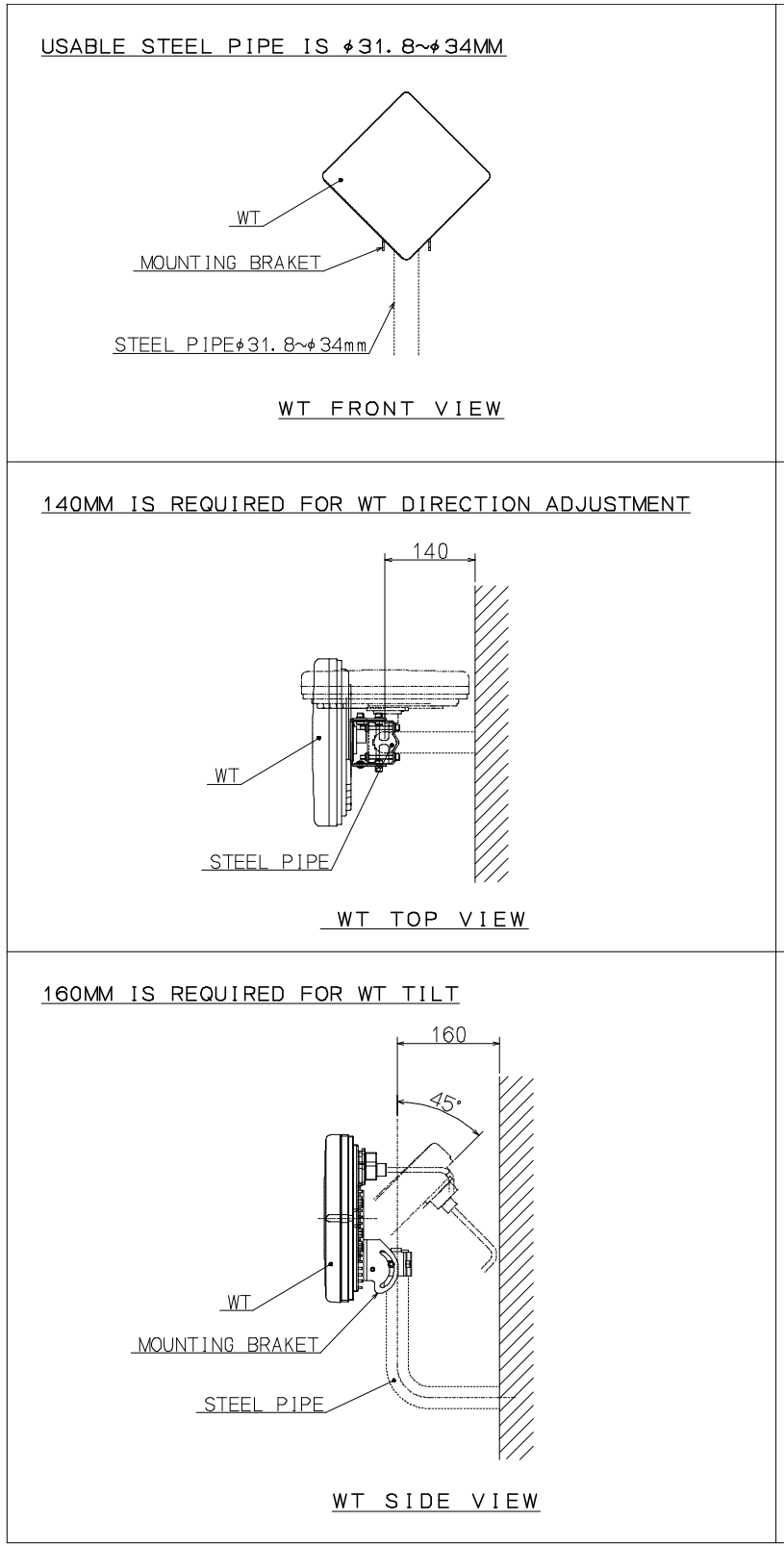


Figure 6-5 The required space of installation

6.5.2.Example of Installing the WT

(1) On a metal fence

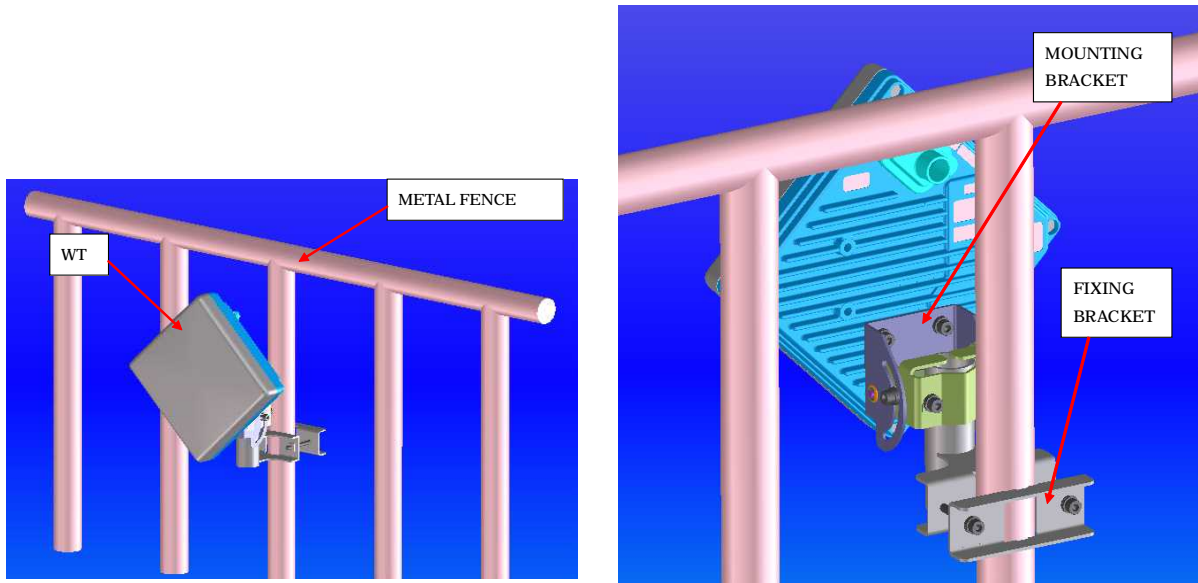


Figure 6-6 Installing on a metal fence

(2) On a house wall

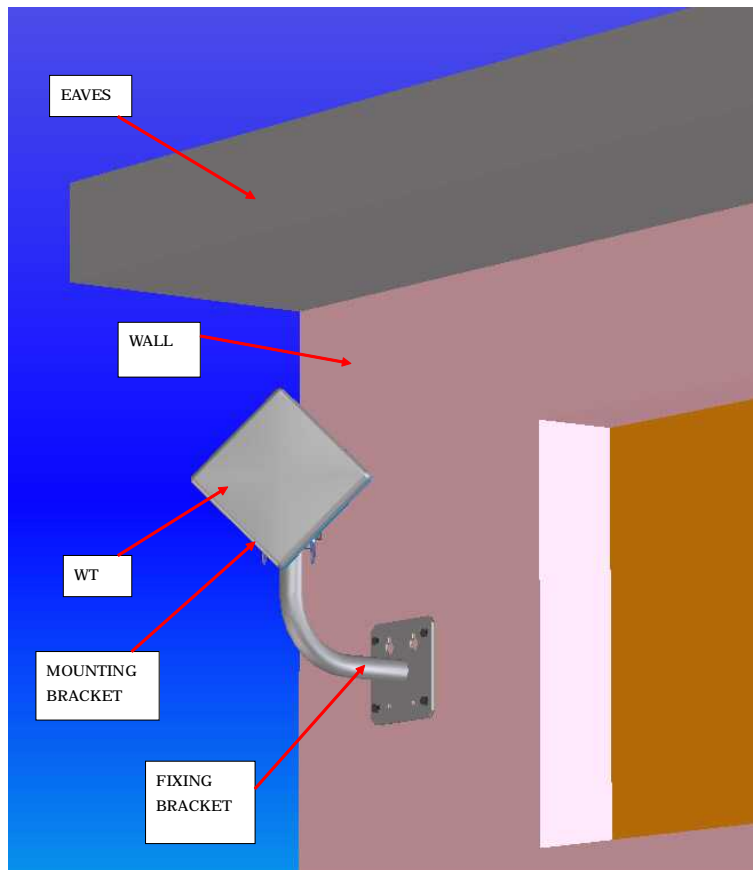


Figure 6-7 Installing on a house wall

6.5.3. Setting the WT for Vertical or Horizontal Polarization

Rotate the antenna ninety degrees to choose between vertical or horizontal polarization

For vertical polarization, position **TOP V** at the top.

For horizontal polarization, position **TOP H** at the top.

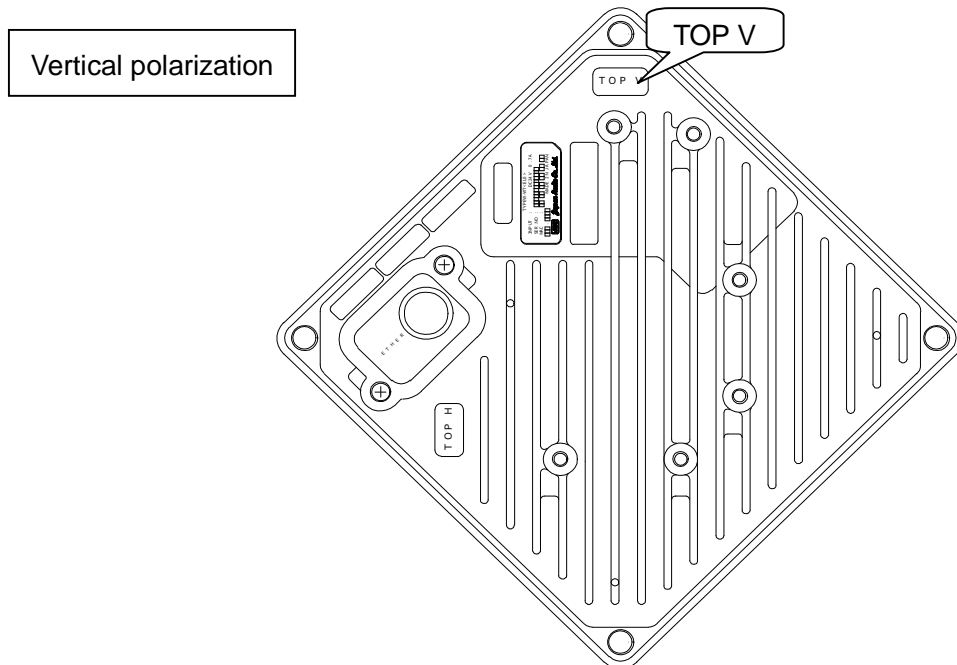


Figure 6-8 Vertical Polarization

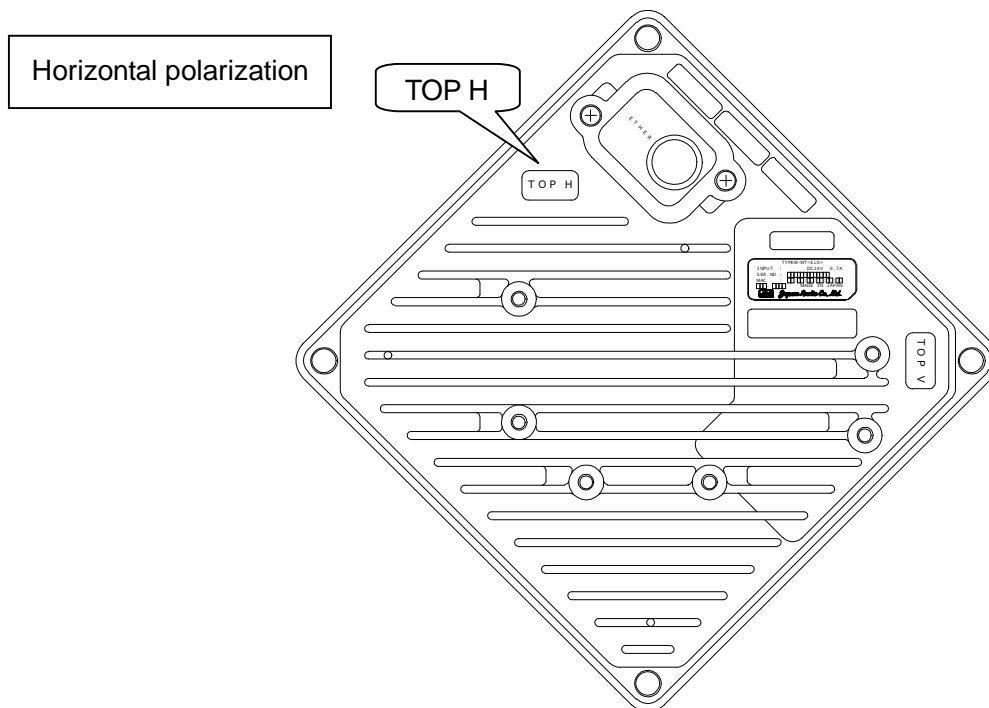


Figure 6-9 Horizontal Polarization

6.6. Installing the WT (External Antenna)

6.6.1. Installing the WT (External 30cm Antenna)

1. Φ30cm antenna installation procedure

1) According to the antenna manual of RADIO WAVES, INC., set it up on the pole. (Figure 6-10)

2) Spread specified grease on the O-ring.
The spreading method depends on the manual. (Figure 6-11)

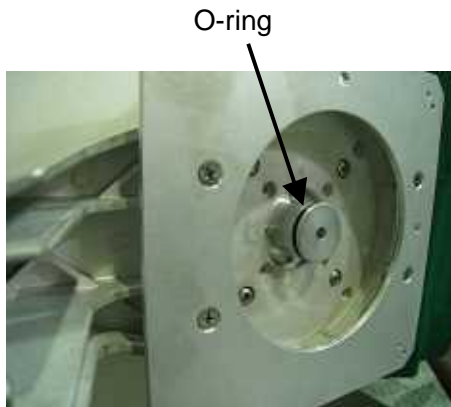


Figure 6-11



Figure 6-10 Φ30cm antenna

2. WT installation procedure

Attach the antenna adaptor to the WT with the O-ring using four M3 screws. (Figure 6-12 & Figure 6-13)

Tightening torque : 57 N·cm

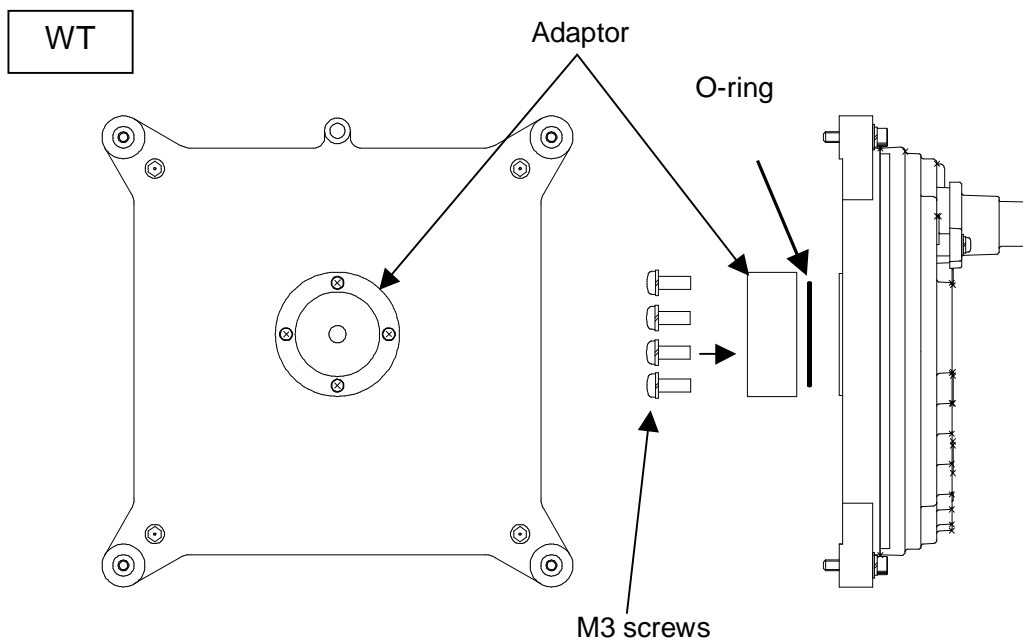
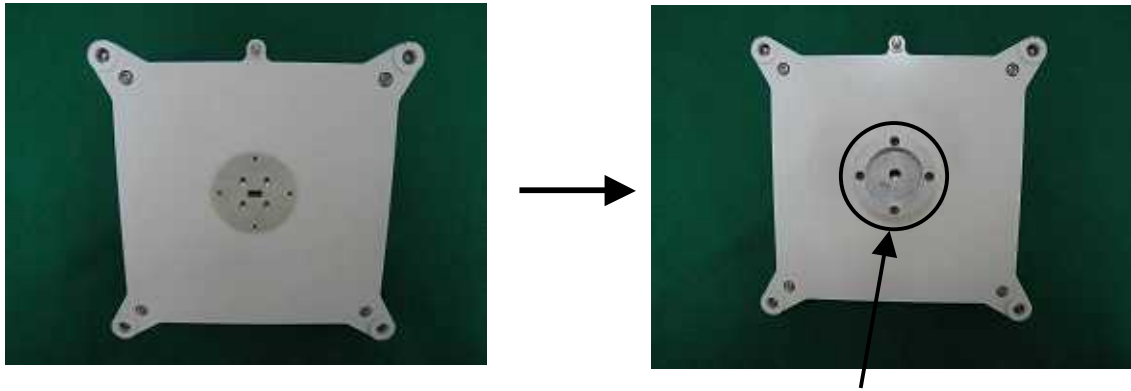


Figure 6-12



After installing the adaptor

Figure 6-13

3. Attachment of the WT to the antenna

1) V(ertical) polarization

When using the V polarization, the guide pin of the WT should be turned to right above and inserted into the V guide hole of the plate. (Figure 6-14 & Figure 6-15)



Guide pin



V polarization

Figure 6-15

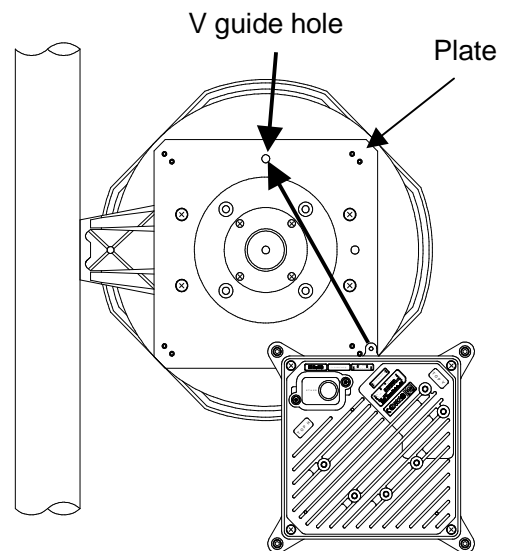


Figure 6-14

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 6-16)

Tightening torque : 265 N·cm

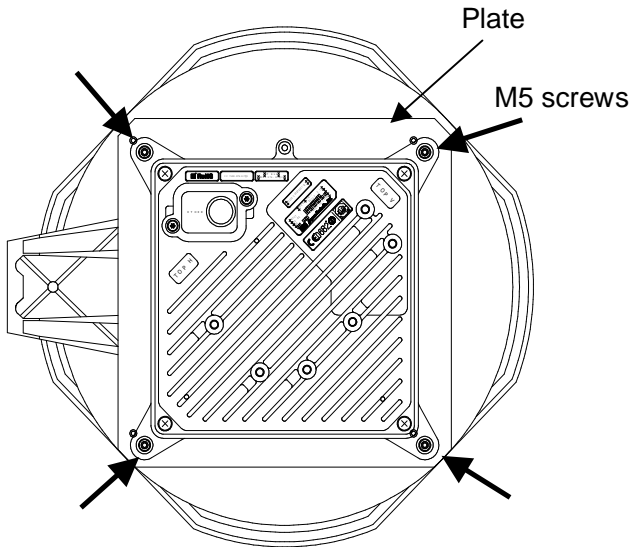


Figure 6-16

2) H(orizontal) polarization

When using H polarization, the guide pin of the WT should be rotated to the right and inserted into the H guide hole of the plate. (Figure 6-17& Figure 6-18)



Figure 6-17

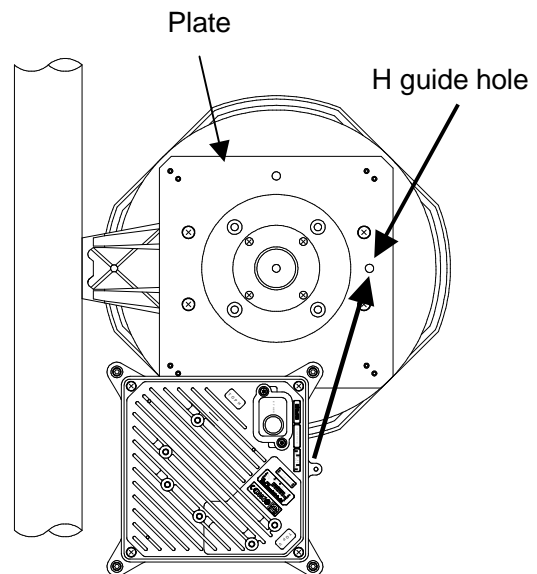


Figure 6-18

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 6-19)
Tightening torque : 265 N·cm

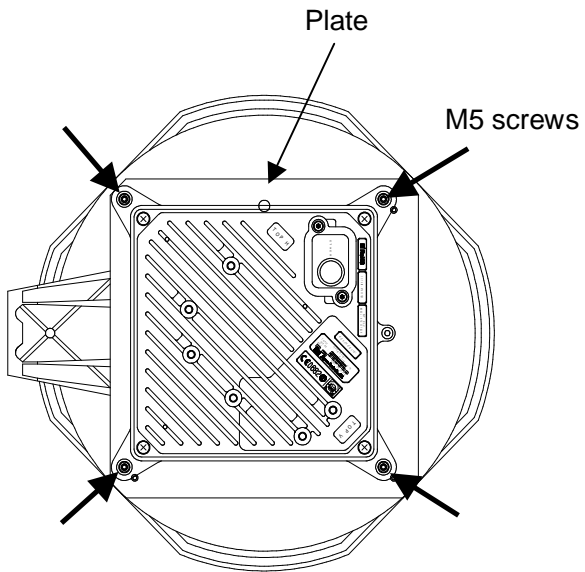


Figure 6-19

6.6.2. Installing the WT (External 60cm Antenna)

1. $\Phi 60$ cm antenna installation procedure

1) According to the antenna manual of RADIO WAVES, INC., set it up on the pole. (Figure 6-20)

2) Spread specified grease on the O-ring.
The spreading method depends on the manual. (Figure 6-21)

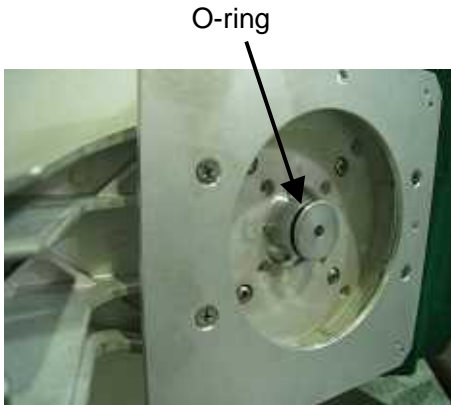


Figure 6-21



Figure 6-20 $\Phi 30$ cm antenna

2. WT installation procedure

Attach the antenna adaptor to the WT with the O-ring using four M3 screws. (Figure 6-22 & Figure 6-23)

Tightening torque : 57 N·cm

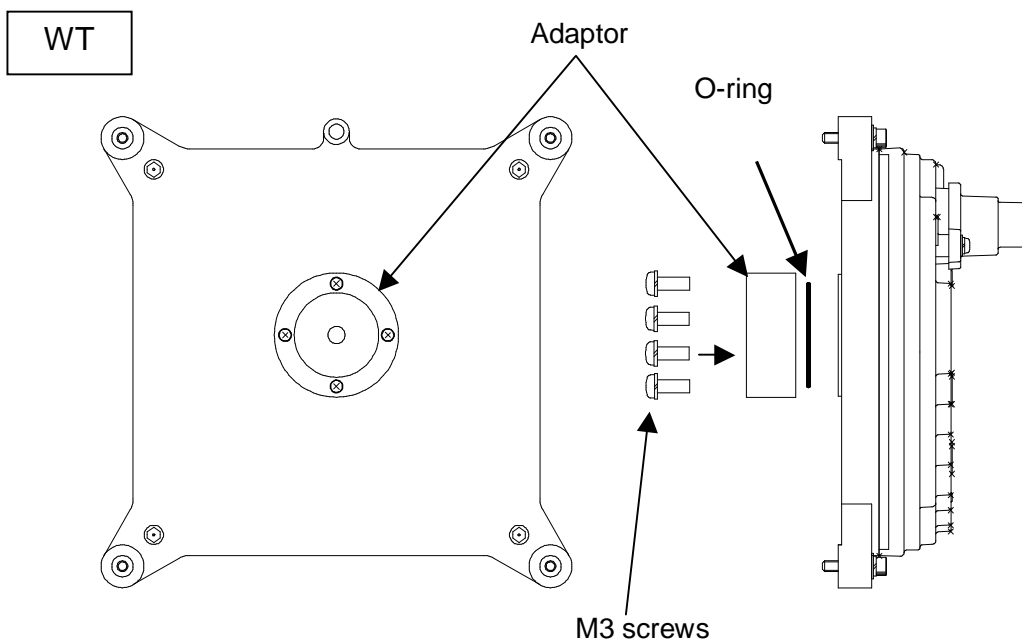
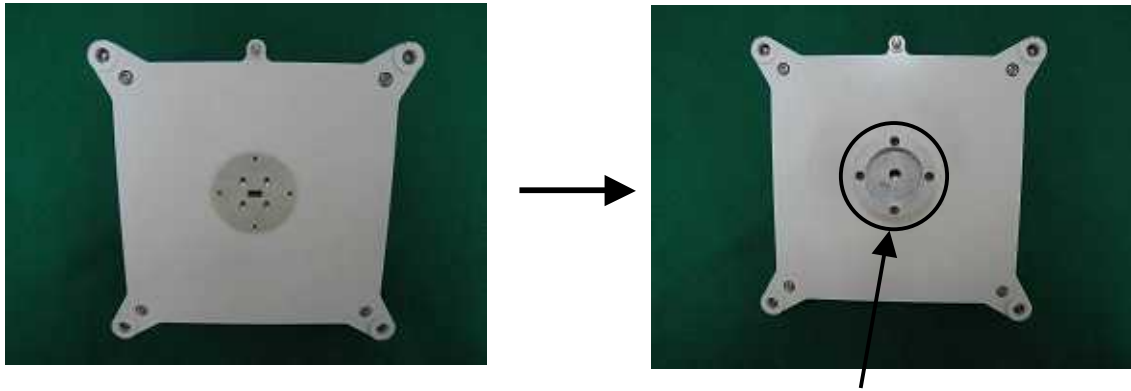


Figure 6-22



After installing the adaptor

Figure 6-23

3. Attachment of the WT to the antenna

1) V(ertical) polarization

When using the V polarization, the guide pin of the WT should be turned to right above and inserted into the V guide hole of the plate. (Figure 6-24 & Figure 6-25)



Guide pin



V polarization

Figure 6-25

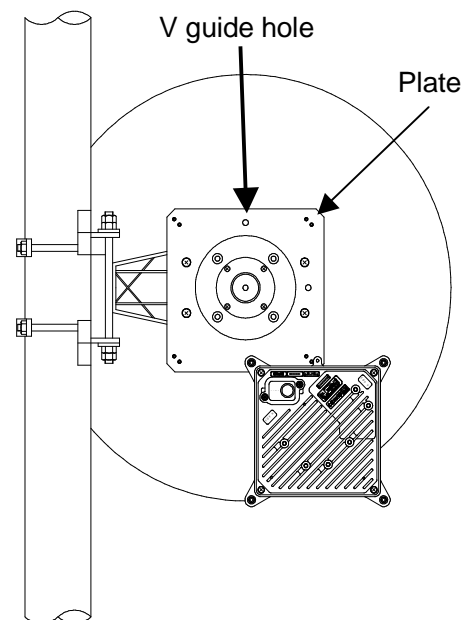


Figure 6-24

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 6-26)

Tightening torque : 265 N·cm

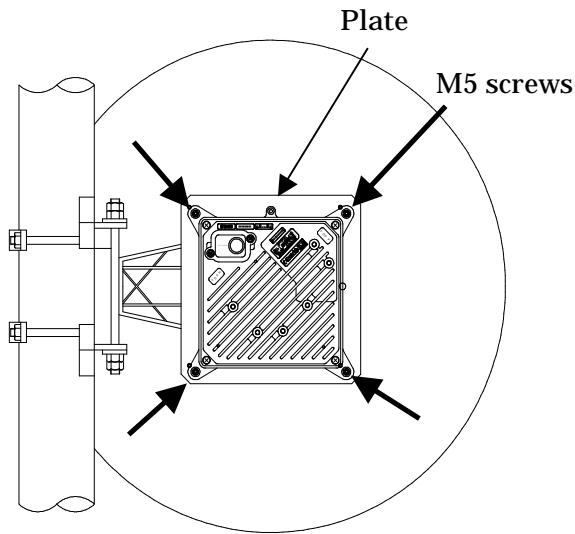


Figure 6-26

2) H(orizontal) polarization

When using H polarization, the guide pin of the WT should be rotated to the right and inserted into the H guide hole of the plate. (Figure 6-27 & Figure 6-28)



Figure 6-27

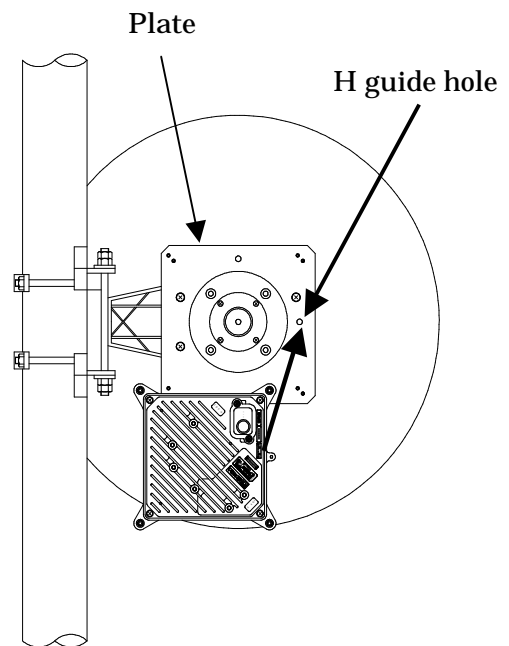


Figure 6-28

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 6-29)
Tightening torque : 265 N·cm

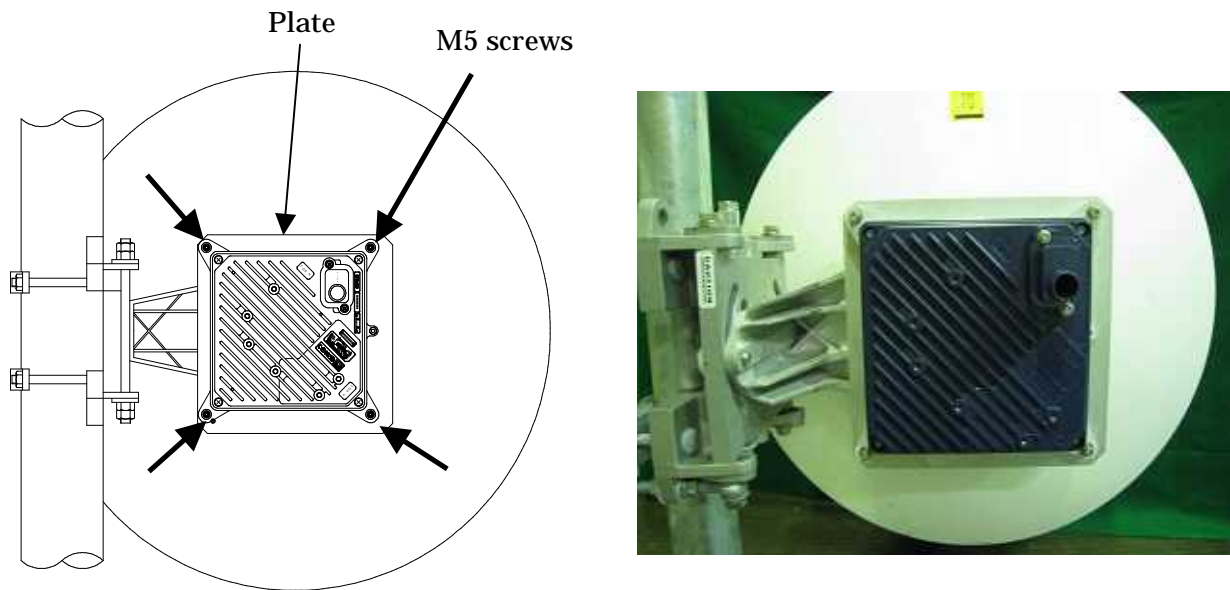


Figure 6-29

6.7. Adjusting the Direction of the WT

To adjust the direction of the WT antenna, use the Antenna direction adjustment tool together with the WT Local Management Tool.

Step1 Connecting the WT Local Management Tool and display the Receiving Level.

- See Subsection 6.7.1

Step2 Rough adjustment

- Install the Antenna direction adjustment tool.
- See Subsection 6.7.2

Step3 Fine adjustment

- See Subsection 6.7.3

Step4 Verification

- After adjust the direction, use the WT Local Management Tool to final check the receive level.

If the receive level value is within the standard range, the procedure for adjusting the antenna direction has been completed.

If the receive level value is lower than a standard value, you need to perform Step 3 again.

- Exit the WT Local Management Tool, and remove the Ethernet cable from the WT adapter.
- Remove the Antenna direction adjustment tool.

6.7.1. Connecting the WT Local Management Tool

(1) As shown in Figure 6-30, connect the WT Local Management Tool (PC) to the WT adapter.

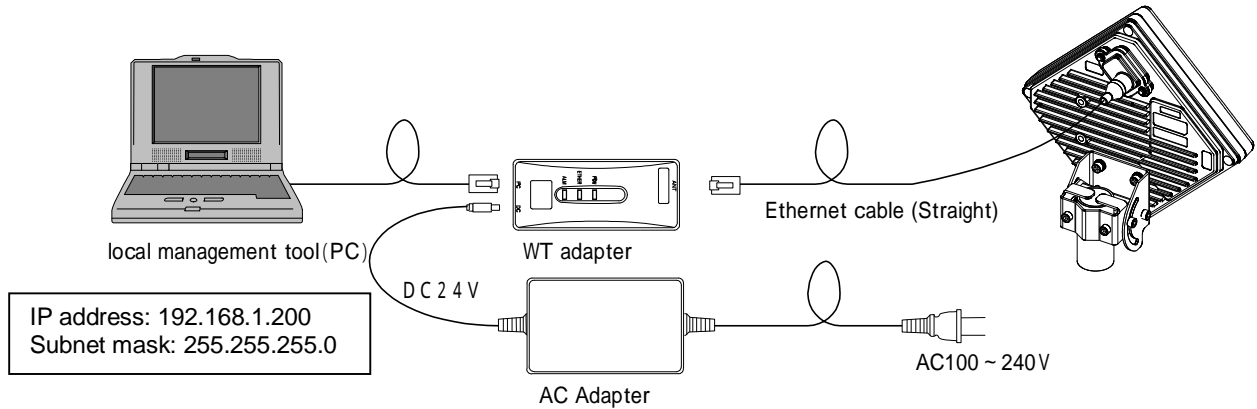


Figure 6-30 How to Install the Cabling

(2) Method of measuring the receive level of the WT (P-MP mode)

STEP1 Start the WT Local Management Tool in P-MP mode.

STEP2 Go to the Radio Link Monitor screen of the WT in P-MP mode and display the Receiving Level.

The procedure is shown in Figure 6-31.

! • The Receiving Level provides a display interval of 1 second, and you need to adjust the antenna direction slowly.

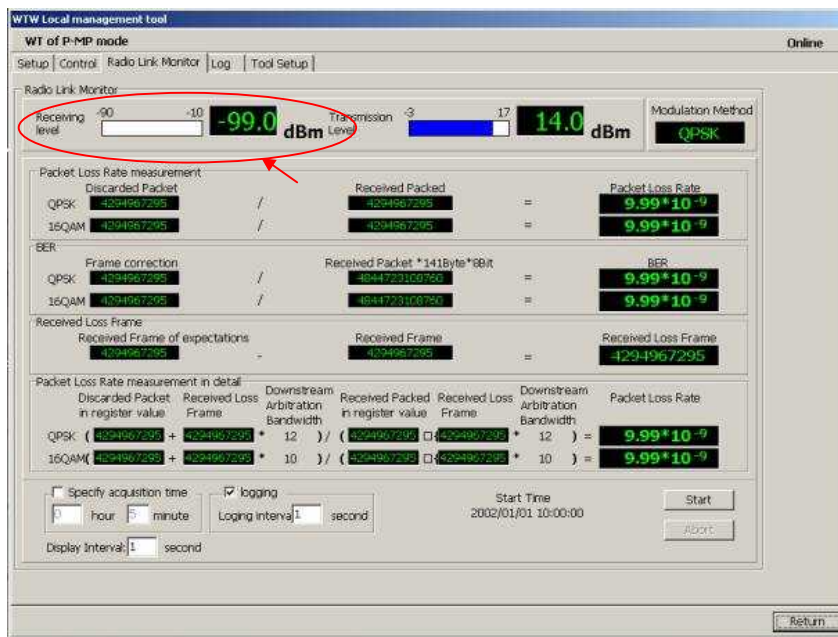


Figure 6-31 Method of Measuring the Receive Level

6.7.2. Roughly Adjusting the Direction

- Step1 As shown in Figure 6-32 and Figure 6-33, use the wing bolt (a) to attach the Antenna direction adjustment tool.
- Step2 As shown in Figure 6-34, loosen the hexagonal socket head bolts (b) and (c) securing the mounting bracket and swing the antenna left or right. Adjust the antenna approximately for the WT direction and finger-tighten the bolts (b) and (c).
- Step3 As shown in Figure 6-35, loosen the bolts (d), (e), and (f) and tilt the antenna up or down. Perform vertical-direction adjustment so that the WT of the opposite station can be seen through the scope of the Antenna direction adjustment tool.

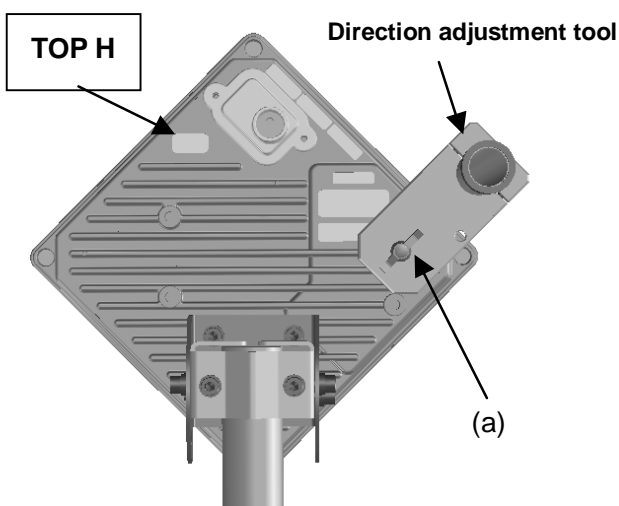


Figure 6-32 How to Install Direction Adjustment tool when the antenna type is the horizontal polarization

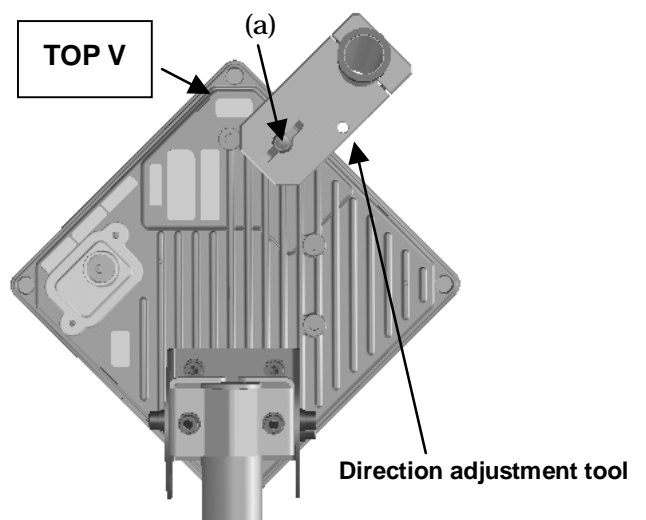


Figure 6-33 How to Install Direction Adjustment tool when the antenna type is the vertical polarization

In Figure 6-34 and Figure 6-35 is an example when the antenna type is the horizontal polarization.

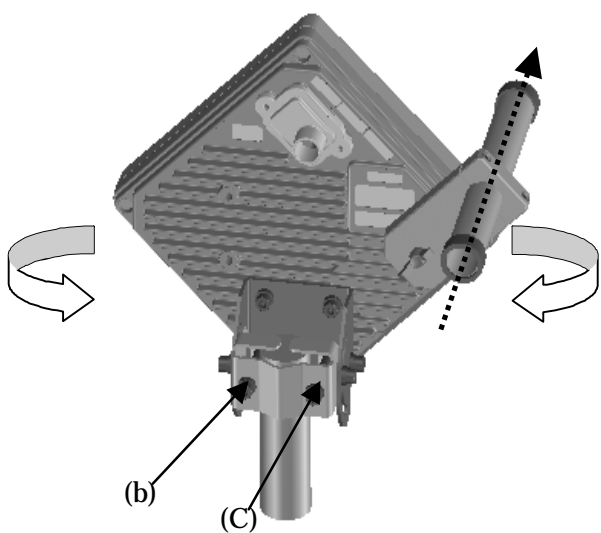


Figure 6-34 Rough-adjusting Horizontal Direction

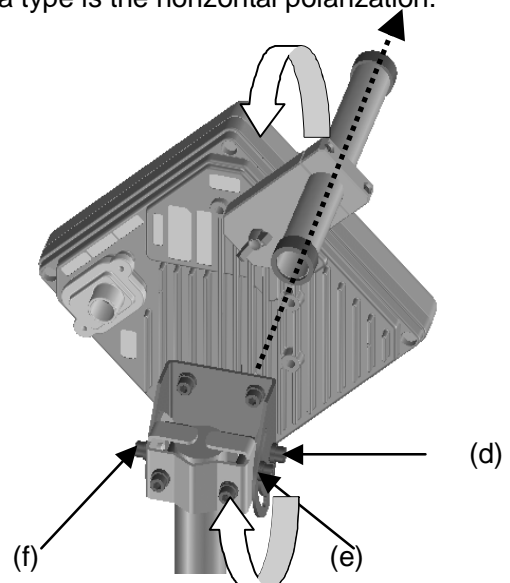


Figure 6-35 Rough-Adjusting the Vertical Direction



• Never look at the sun directly. Doing so may seriously damage the eyes.

6.7.3. Finely Adjusting the Direction

Step 1: Horizontal direction

As shown in Figure 6-36, loosen the hexagonal socket head bolts (a) and (b) securing the mounting bracket and swing the antenna left or right. Adjust the antenna direction so that the receive level indicates the maximum value, and finger-tighten the bolts (a) and (b).

Step 2: Vertical direction

As shown in Figure 6-37, loosen the hexagonal socket head bolts (c), (d), and (e) securing the mounting bracket and tilt the antenna up or down. Adjust the antenna direction so that the receive level indicates the maximum value. Tighten the bolts at a point showing the maximum receive level (tightening torque: $8.5\text{N}\cdot\text{m}$). Tighten the bolts (c), (d), and (e) and make sure that the point showing the maximum receive level is maintained. This concludes the procedure for vertical-direction adjustment.

Step 3: Horizontal direction

Finely adjust the horizontal direction by slightly loosening the bolts (a) and (b) again. Once again, locate the point where the receive level reaches the maximum value and hold that point. Finally, tighten the bolts (a) and (b) (tightening torque: $8.5\text{N}\cdot\text{m}$) while making sure that the point showing the maximum receive level is maintained. This concludes the procedure for horizontal-direction adjustment.

The figures show examples of horizontal polarization setup.

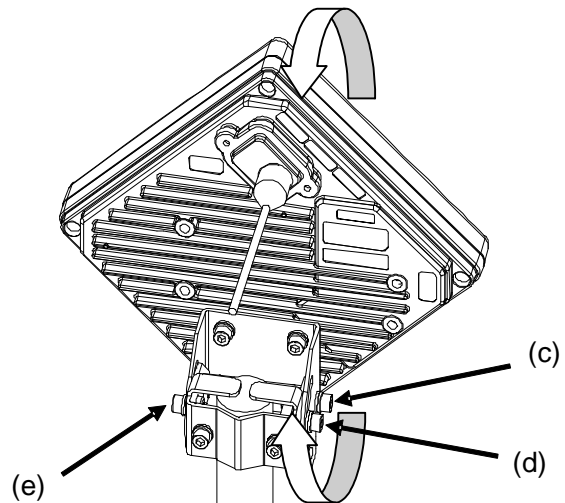
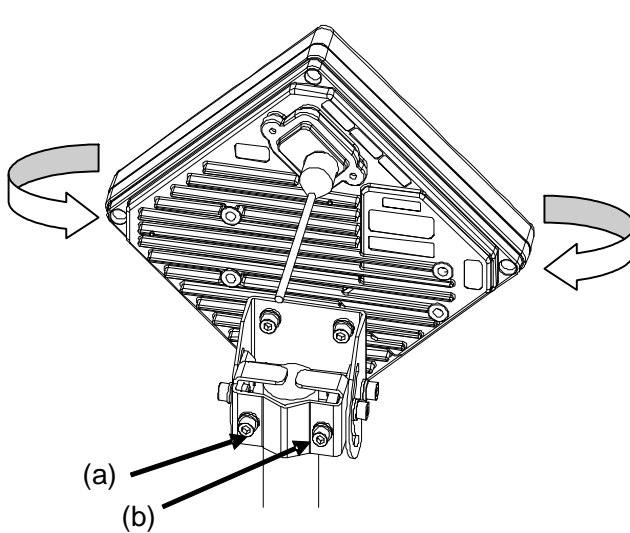


Figure 6-36 Finely Adjusting the Horizontal Direction Figure 6-37 Finely Adjusting the Vertical Direction

Note : When adjusting the antenna direction
When adjusting the direction, you might mistakenly take the antenna's side lobe as the maximum receive level. For fine adjustment, therefore, you should move the antenna some more after the receive level has reached the maximum value to make sure that you have not caught a side lobe.

6.7.4. The receive level and the distance

For the receiving AP-RFU (Sectoral-Horn Antenna) in a point-to-multipoint system, the receiving level at clear sky and the distance are related as shown in Figure 6-38.

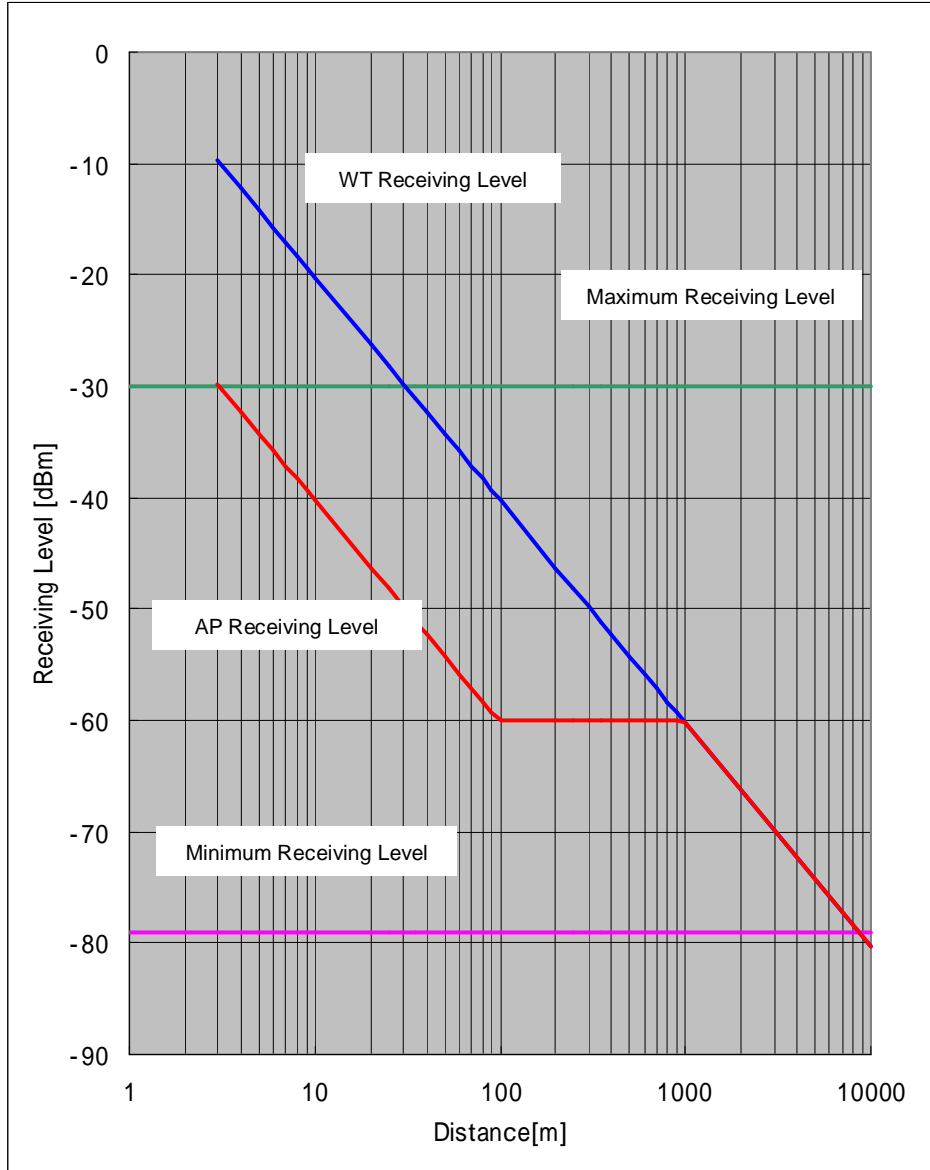


Figure 6-38 Receiving Level and Distance (Sectoral QPSK)

Transmission level (QPSK)	14	[dBm]
Frequency	26	[GHz]
Antenna gain[TX+RX]	46.5	[dBi]
TX Sectoral Antenna Gain:15.5dBi _{TYP}		
RX WT Antenna Gain:31dBi _{TYP}		

Free space loss L_p [dB]

$$[m] = \frac{c [m]}{f [Hz]}$$

$$L_p = 20 \log \left[\frac{4}{d} \right]$$

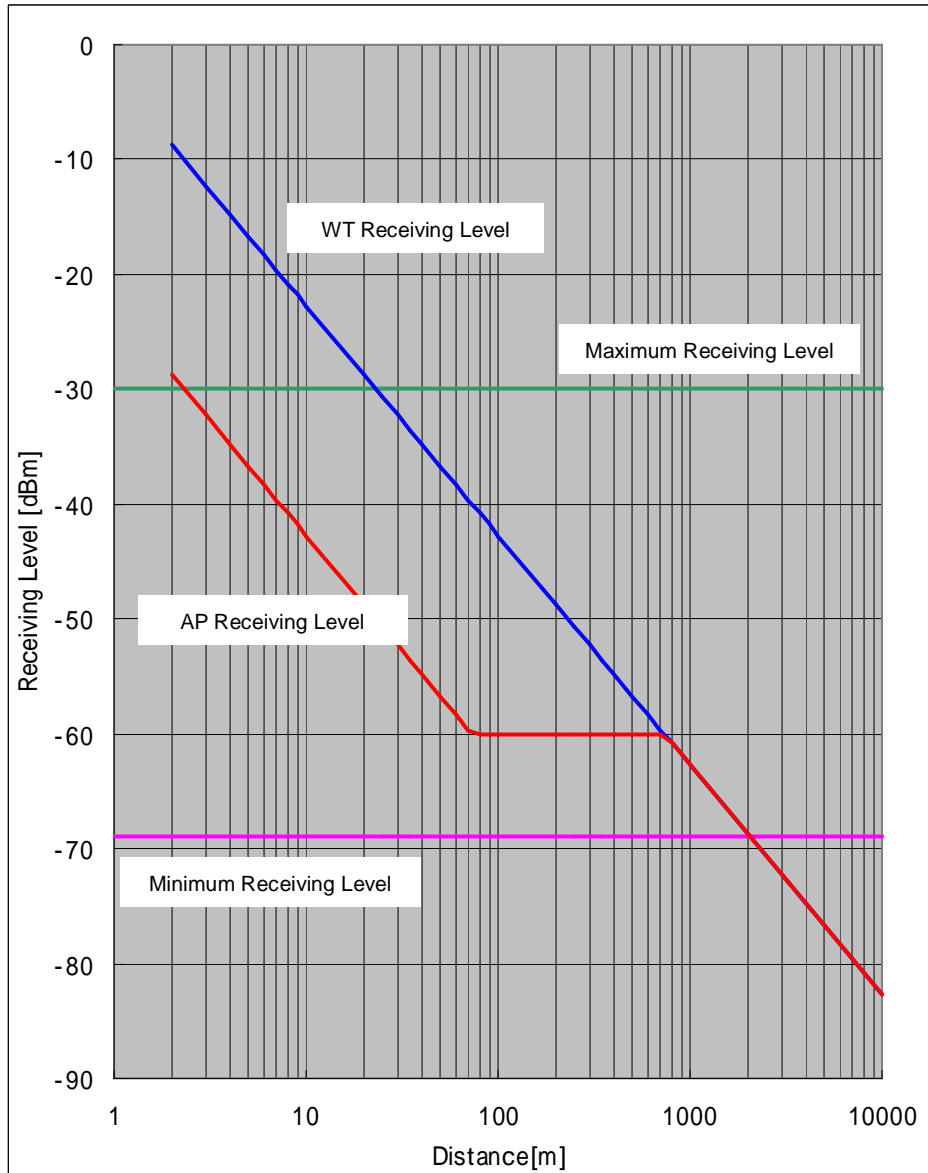


Figure 6-39 Receiving Level and Distance (Sectoral 16QAM)

Transmission level (16QAM)	11.5	[dBm]
Frequency	26	[GHz]
Antenna gain[TX+RX]	46.5	[dBi]
TX Sectoral Antenna Gain:15.5dBi _{TYP}		
RX WT Antenna Gain:31dBi _{TYP}		

Free space loss L_p [dB]

$$[m] = \frac{c[m]}{f[Hz]}$$

$$L_p = 20 \log \left[\frac{4}{d} \right]$$

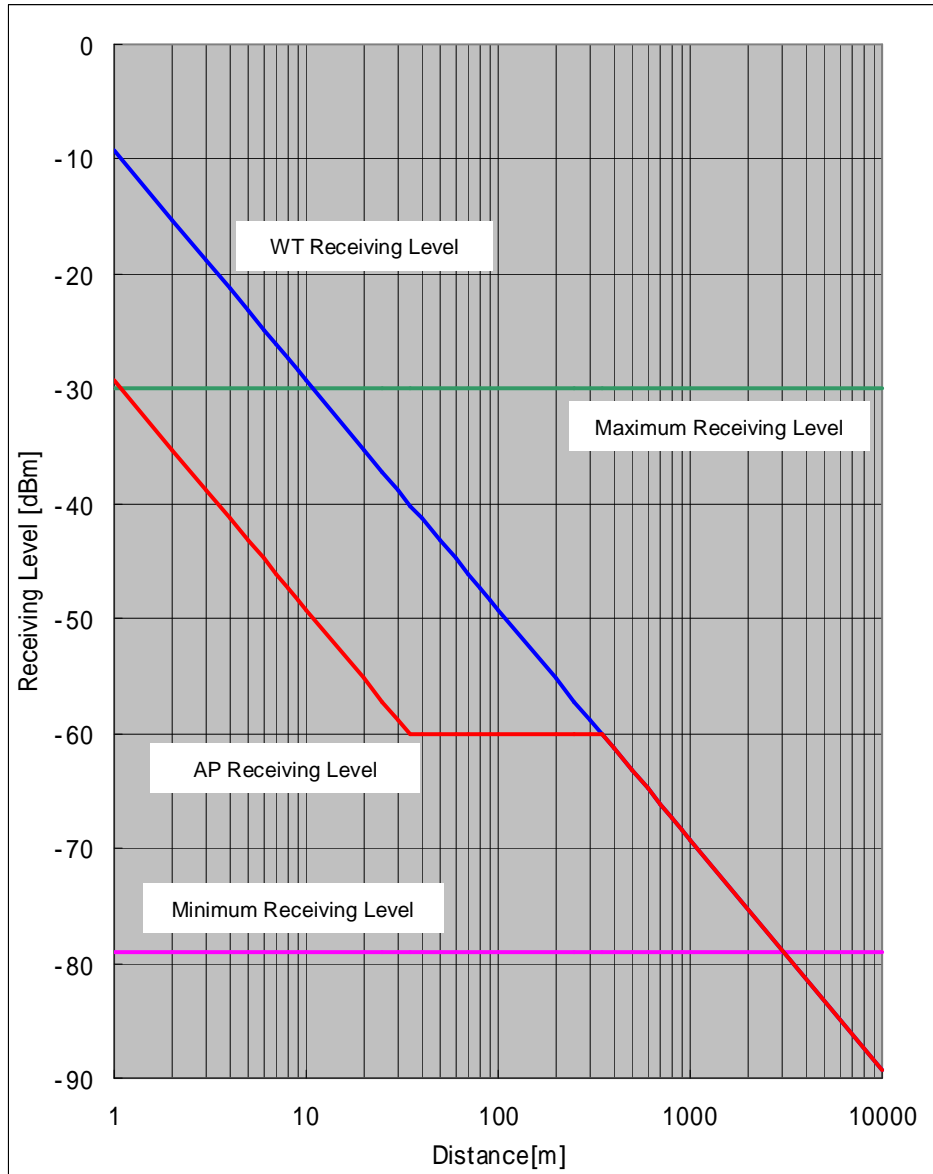


Figure 6-40 Receiving Level and Distance (Omni QPSK)

Transmission level (QPSK)	14	[dBm]
Frequency	26	[GHz]
Antenna gain[TX+RX]	37.5	[dBi]
TX Sectoral Antenna Gain:6.5dBi _{TYP}		
RX WT Antenna Gain:31dBi _{TYP}		

Free space loss L_p [dB]

$$[m] = \frac{c[m]}{f[Hz]}$$

$$L_p = 20 \log \left[\frac{4}{d} \right]$$

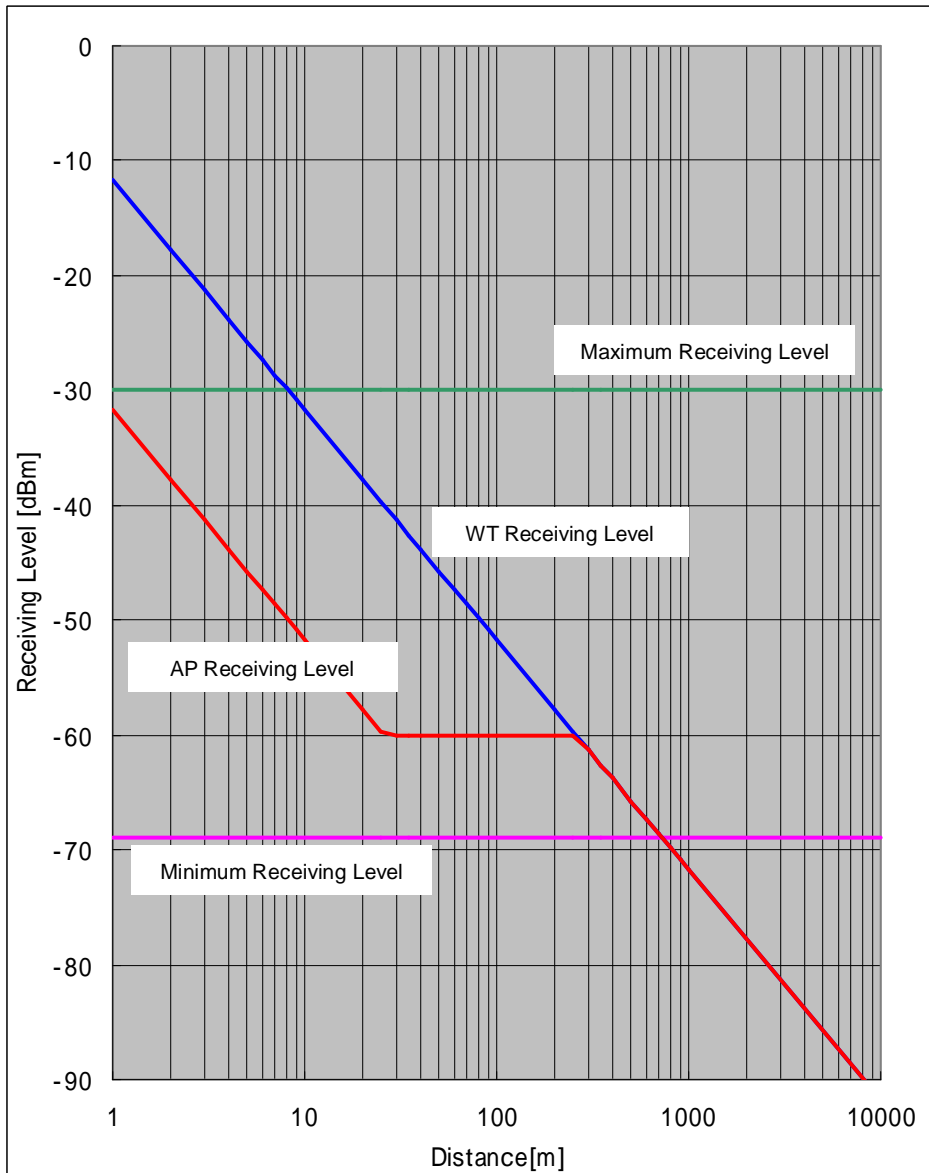


Figure 6-41 Receiving Level and Distance (Omni 16QAM)

Transmission level(16QAM)	11.5 [dBm]
Frequency	26 [GHz]
Antenna gain[TX+RX]	37.5 [dBi]
TX Sectoral Antenna Gain:6.5dBi _{TYP}	
RX WT Antenna Gain:31dBi _{TYP}	

Free space loss L_p [dB]

$$[m] = \frac{c [m]}{f [Hz]}$$

$$L_p = 20 \log \left[\frac{4 d}{\lambda} \right]$$

6.8. Installing the WT Adapter

WT Adapter is installed in indoor

It is an example of installing the appended wood screw.

Screw into the mounting position the wood screw that comes with the WT adapter, leaving 2 mm.

Hook the WT adapter on the wood screw.

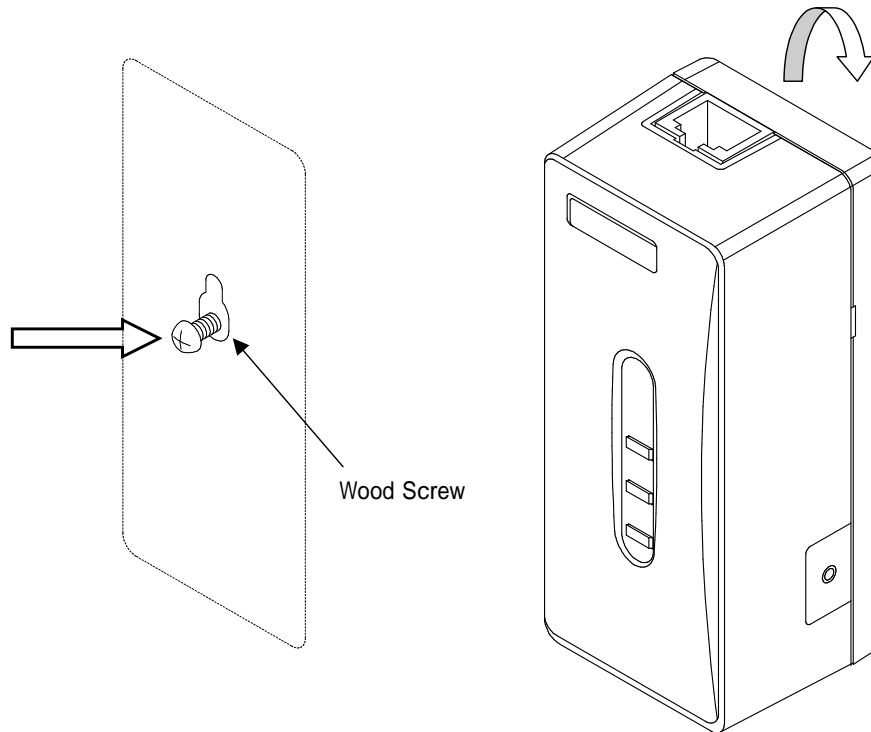


Figure 6-42 Installing the WT Adapter on the Wall

6.9. Connecting Cables to the WT

Use an Ethernet cable (straight) to connect the WT and the WT adapter as shown in Figure 6-43.

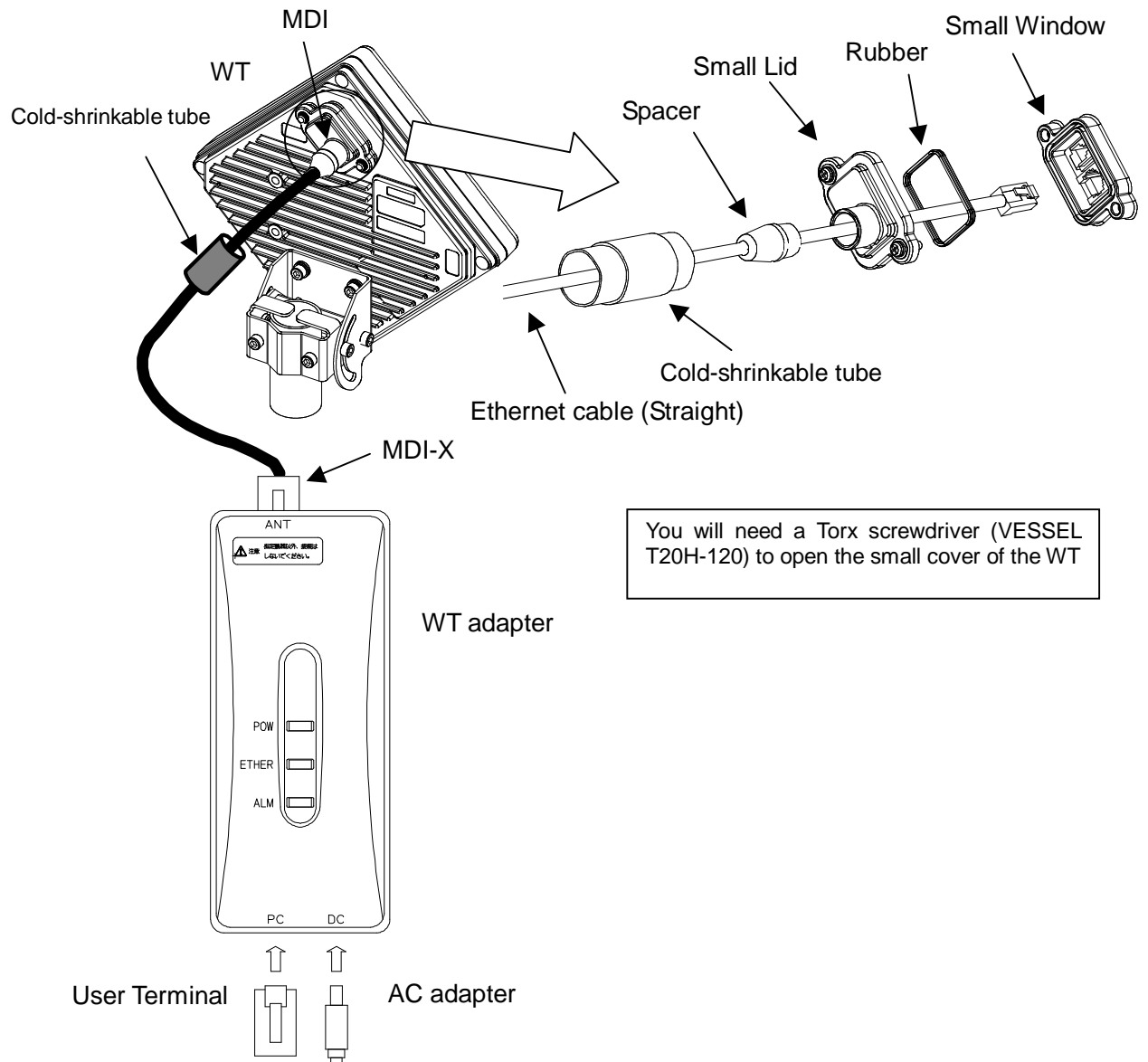


Figure 6-43 Connecting Cables to the WT

(1) Connected cable between WT and ANT port of WT adapter

Cable	
Cable type	Ethernet cable for outdoor, straight
Range of applicable outer diameter	φ5.0 mm ~ 5.7mm
Cable length	50m (maximum)
Connector of both side	
Shape	RJ-45
Cable connection	Straight connection - WT : MDI - ANT port of WT adapter : MDI-X An Ethernet cable has eight signal lines. Four lines are used to carry Ethernet signals. The remaining four lines are used as power lines and LED control lines.

(2) Connect the user terminal to PC port of WT adapter

Interface	
Interface	10BASE-T / 100BASE-TX
Connector	
Shape	RJ-45
Pin assign	Ethernet signal (MDI-X)
Cable	
Communication terminal	Cable connection
PC	straight
HUB	crossover
ROUTER	straight

(3) Connect the AC adapter to DC port to the WT adapter



- Never connect your personal computer to the ANT port of the WT adapter. Doing so may damage your personal computer.



- The cable connecting between the WT and WT adapter carries 24 VDC for the WT in addition to Ethernet signals. Before unplugging the cable connecting between the WT and WT adapter, make sure to unplug the DC jack of the WT adapter to turn the power off. Otherwise, the unit may be damaged.
- When closing the small window, make sure that the rubber packing of the small window is free from any foreign matter.
- The cable connecting the WT and WT adapter is a straight cable. Wrong connection may damage the unit.
- The Equipment for connection to WT adapter PC-interface(RJ-45) shall be appropriate to connect to TNV-1 circuits.
- For the connection WT adapter to WT and a cable suitable for outdoor use shall be installed.

6.10. Waterproofing WT small window

- (1) Pass the Ethernet cable through the cold-shrinkable tube (a) from the bonded portion of the spiral tube. Pay attention to the insertion direction (Figure 6-45).

Applicable LAN cable diameter: 5.0 mm to 5.7 mm

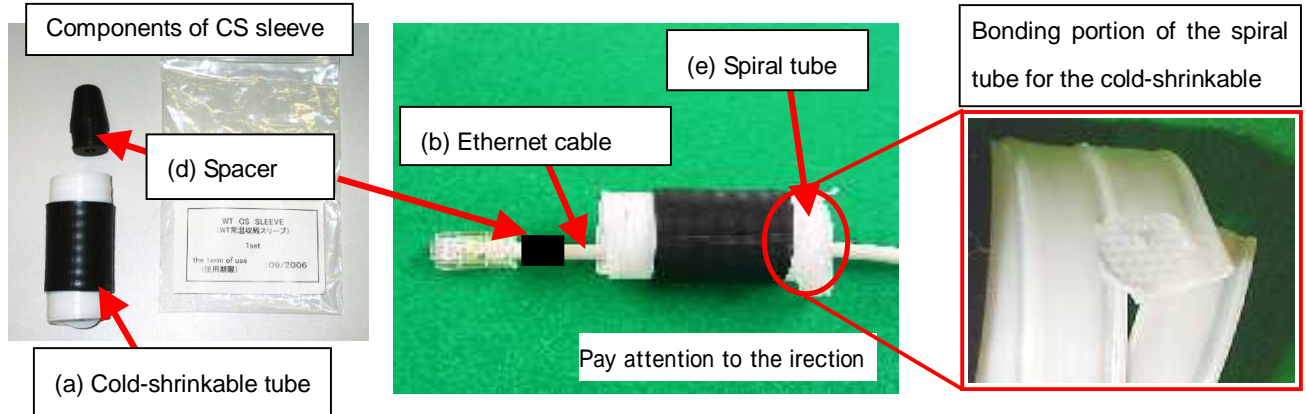


Figure 6-44

Figure 6-45

- (2) Connect the Ethernet cable to the WT (Figure 6-46).
- (3) Using cable ties (c) or the like, secure the Ethernet cable to the supporting bracket. Attach the cable ties 70 to 100 mm from the end of the supporting bracket. The cable is approximately 300 mm long measured from the cable joint (with a diameter of approximately 200 mm) to the first cable tie (Figure 6-47).



Figure 6-46

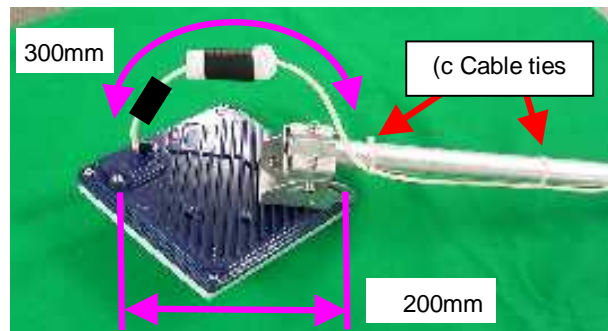
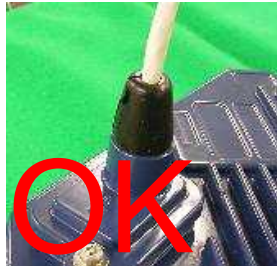


Figure 6-47



- Never allow the inside of the small window to become wet. Dampness may cause a malfunction. Connect the Ethernet cable perpendicular to the WT. Failure to do so will spoil the waterproofing effect, resulting in a device malfunction.

Cable perpendicular
to the WT



Bent cable



(4) Mounting spacer (d)

- Mount the spacer on the Ethernet cable .
- Make sure that the spacer is fully inserted in the small Lid of the WT(Figure 6-49).

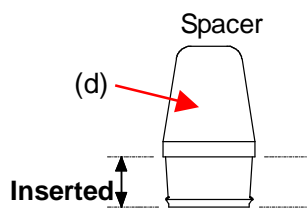


Figure 6-48



Figure 6-49



- Insert the spacer into the small window fully. Partial insertion of the spacer will spoil the waterproofing effect.

(5) Mounting cold-shrinkable tube (a)

- Place the cold-shrinkable tube on the spacer and small Lid (Figure 6-50).
- Butt the end of the cold-shrinkable tube against the base of the small Lid. Pulling white spiral tube (e) to the very edge of the cold-shrinkable tube eases the subsequent procedure (Figure 6-50).
- Pull the spiral tube to mount the edge of the cold-shrinkable tube on the small Lid (Figure 6-51). Make sure that there is no gap between the cold-shrinkable tube and the base of the small Lid and between the spacer and the small Lid.
- Pull the spiral tube to mount the cold-shrinkable tube, paying attention so the spacer is not lifted (Figure 6-52 and Figure 6-53). Make sure that the spacer is not protruded from the cold-shrinkable tube. The top of the cold-shrinkable tube should be 5 mm or less from the top of the spacer.



Figure 6-50



Figure 6-51

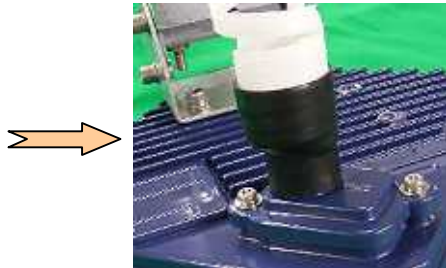


Figure 6-52

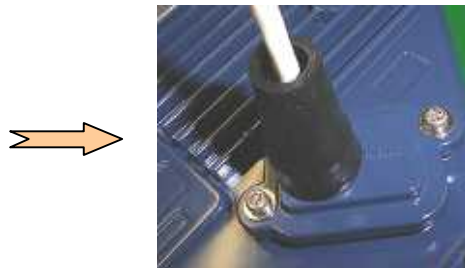
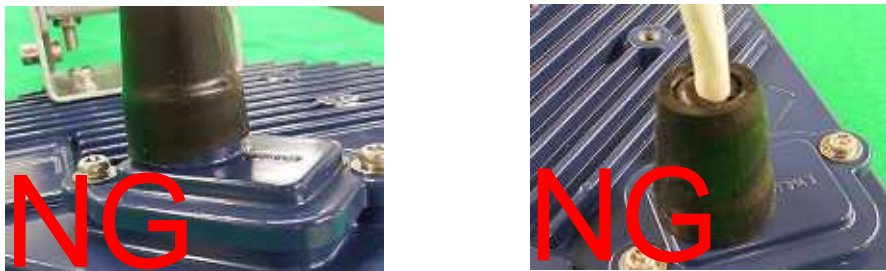


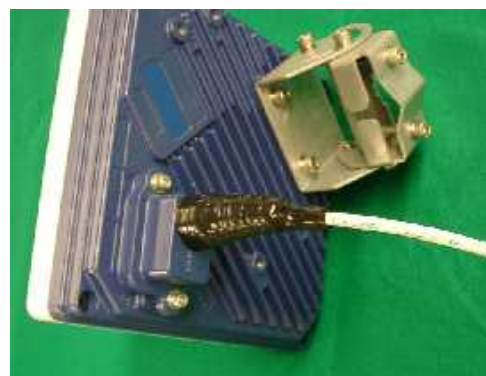
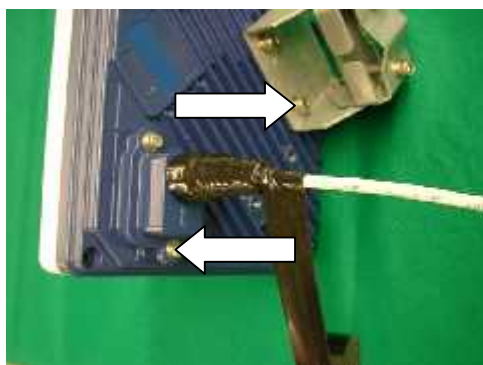
Figure 6-53

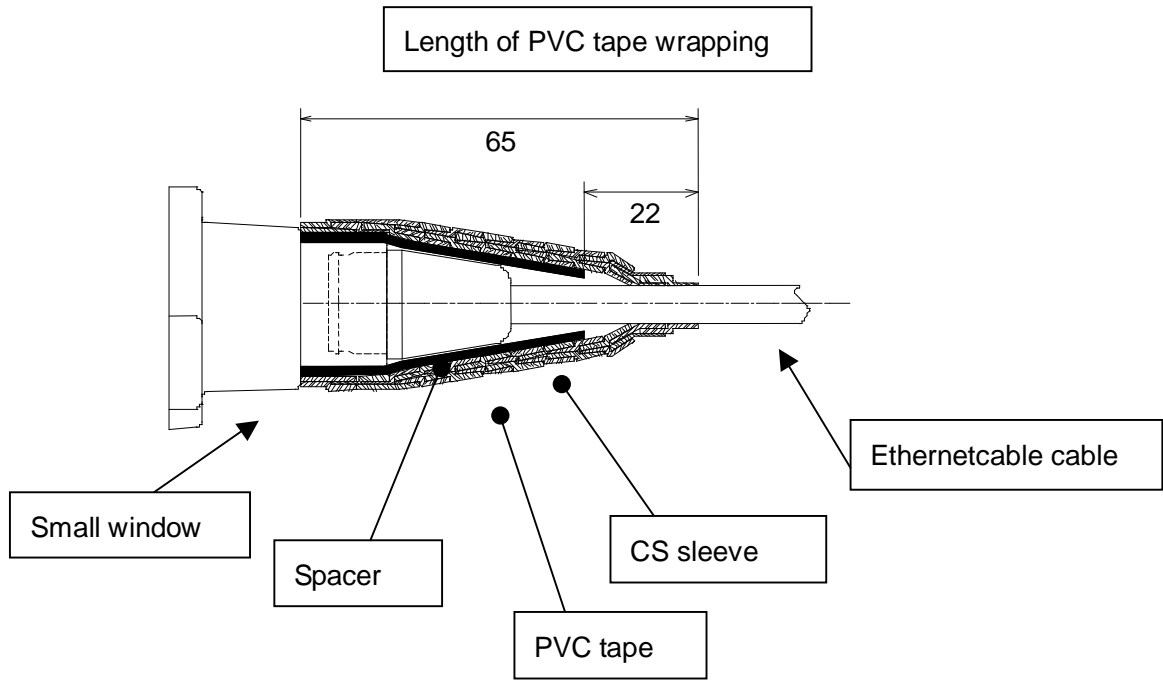
! • Slanted mounting of the cold-shrinkable tube as shown below will spoil the waterproofing effect. If the top of the cold-shrinkable tube is 5 mm or less from the top of the spacer, this will also spoil the waterproofing effect.



(6) Wrap the cable with PVC tape (for class 2 protection).

Apply the PVC tape so that the cold-shrinkable tube is completely hidden. Wrap the tape from the small Lid of the WT to the Ethernet cable, overlapping half of the previous layer. Next, reverse the wrapping direction and wrap one more time to the starting point.

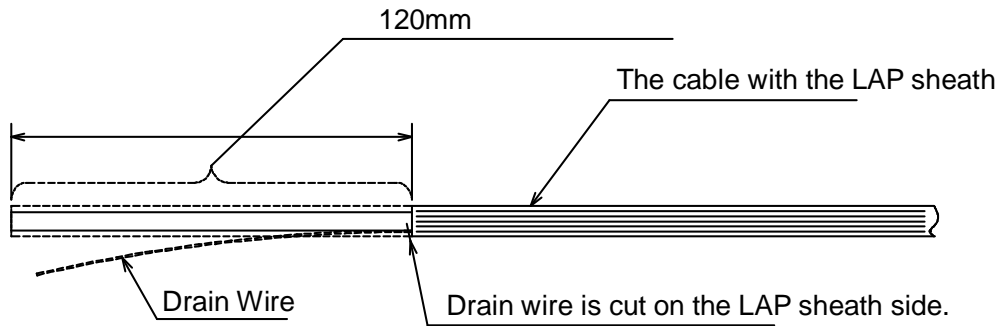




6.11. When you use the cable with the LAP sheath for outdoor

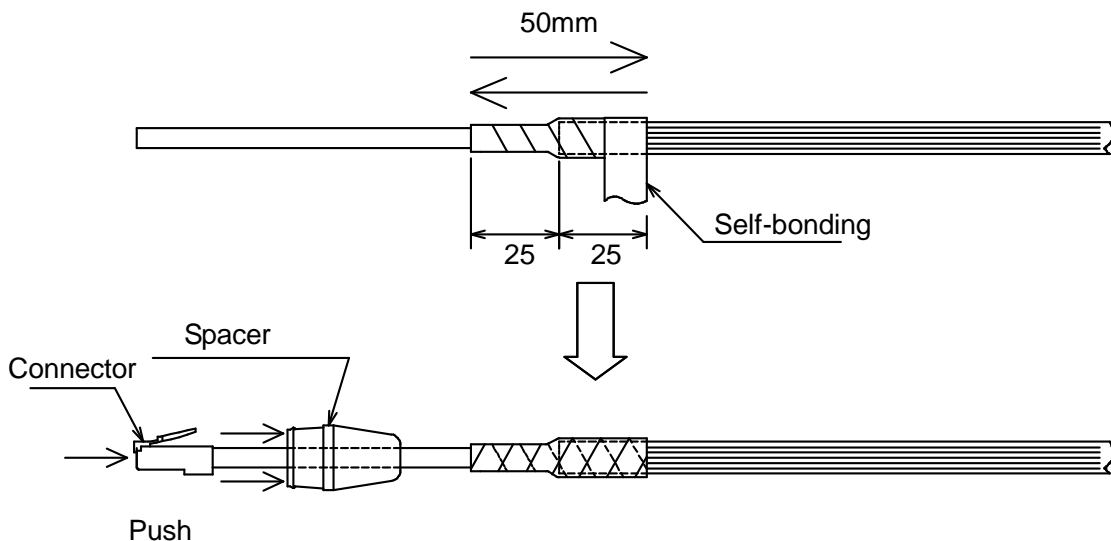
1 . Processing of LAP sheath

- The LPA sheath is peeled off from the cable point to 120mm.
- It cuts it in the part peeled off when there is drain wire.



2 . Processing of cutting part

- To prevent water being infiltrated in the wire, the self-bonding tape is rolled in the part where the LAP sheath was peeled off as shown in the figure below.
- The Ether plug is installed with the normal temperature shrinkage sleeve and Spasa passed.



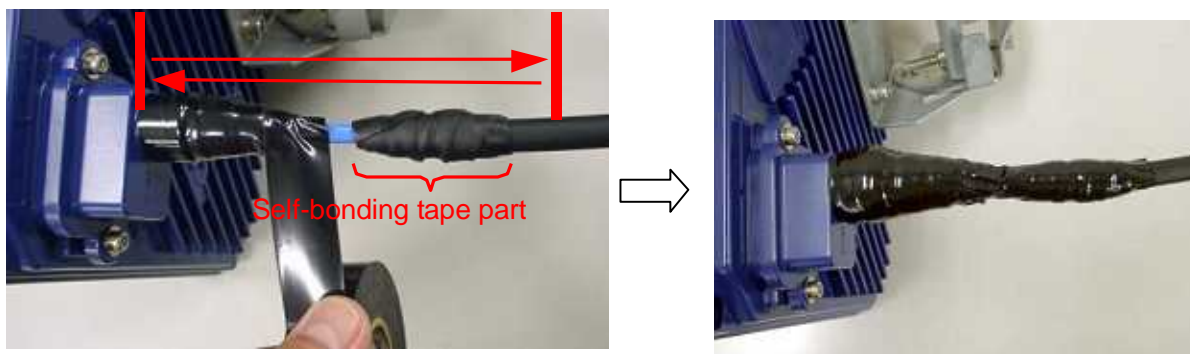
3 . Fixation of cable Ethernet, Installation of Spacer and normal temperature shrinkage sleeve

- See 「 6.9. Waterproofing WT small window 」

4 . Wrapping of PVC tape for protection

- It wraps until the self-bonding tape in the LAP sheath processing part is completely hidden

from a small window to the Ethernet cable side by 1/2 coming in succession, and 1 return round trip to the small window side.

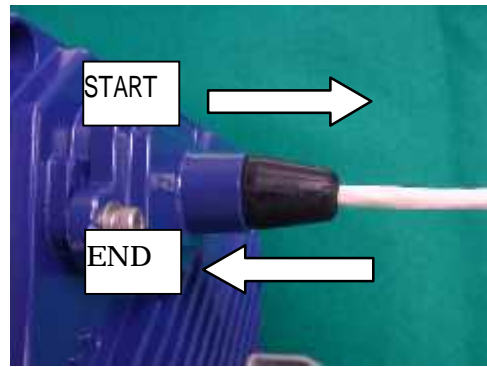


6.12. Waterproofing Without Using a Cold-Shrinkable Tube

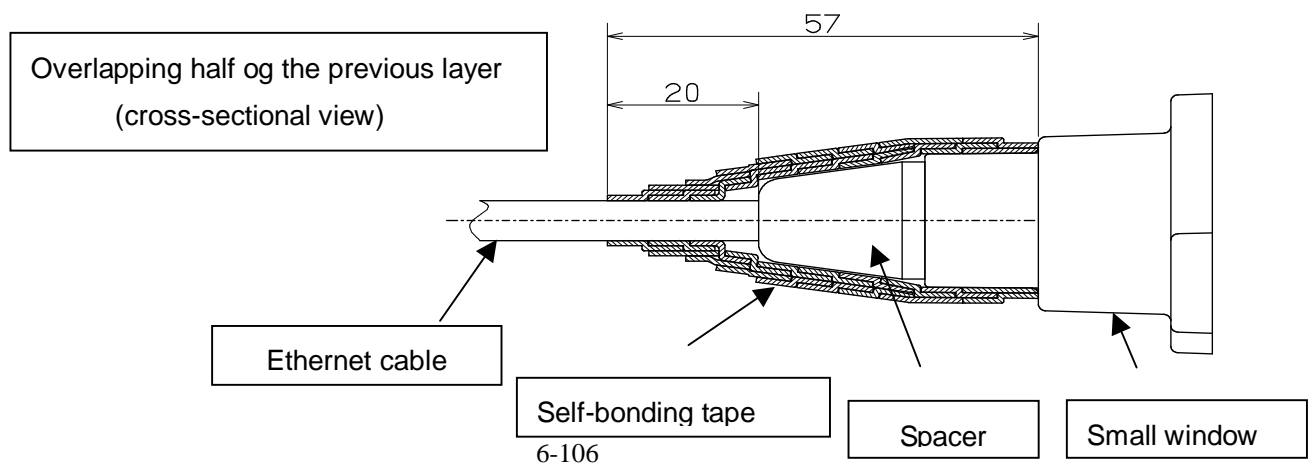
If installing a cold-shrinkable tube fails, use off-the-shelf self-bonding tape to provide the waterproofing.

(1) Securing the small Lid of the WT and the spacer

Using an appropriate length of self-bonding tape, wrap the tape around both the small Lid of the WT (at its base) and spacer one complete turn. After one turn, wrap about seven turns around the Ethernet cable by overlapping one-half of the previous turn. Reverse the wrapping direction and wrap about another seven turns back to the small Lid.



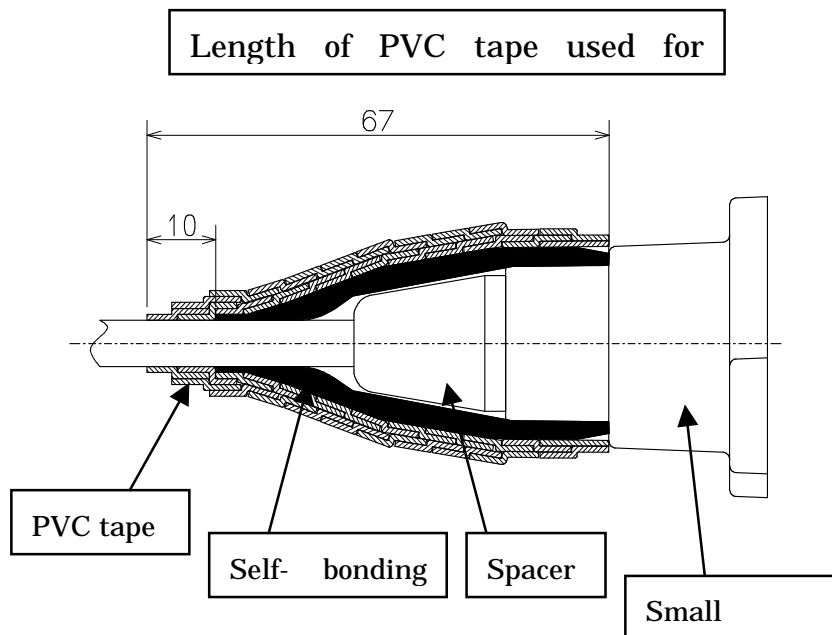
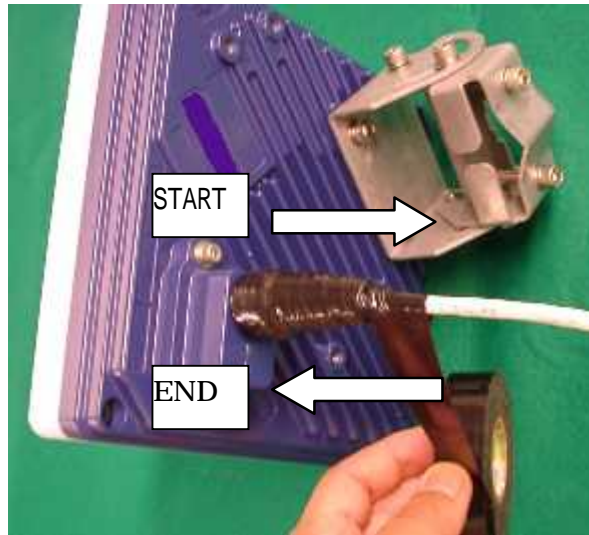
- For the stretching margin of self-bonding tape, see the instruction manual for the product.
- When wrapping self-bonding tape, start at the base of the small window and end at the end of the waterproof sleeve. Next, reverse the direction and end at the base of the small window. This procedure makes an attractive wrapping and improves the waterproof effect by making any air pockets less likely.
- Overlapping the wraps also protects against air pockets.
- Press evenly along the entire length of tape to remove air pockets.
- Make sure that there are no air pockets between the self-bonding tape and the small window of the WT or the rubber bushing. Air pockets will degrade the waterproofing effect.



(2) Wrapping protective PVC tape

Apply the protective PVC tape so that the cold-shrinkable tube is completely hidden. Wrap the tape from the small Lid of the WT to the Ethernet cable, overlapping half of the previous layer. Next, reverse the wrapping direction and wrap one more time to the starting point. Using the PVC tape will guard the self-bonding tape against ultraviolet and other rays. The wrapping also helps increase strength.

Key point: When wrapping PVC tape, be sure that the self-bonding tape is completely covered for its protection.



6.13. Testing

6.13.1. Perform a continuity test

Connect the OpS terminal to an AP, and run a loopback test with the following procedure:

Step 1: Click the Testing tab.

Step 2: Select a WT from the Select WT ID list.

Step 3: Select "Loop back Test."

Step 4: Click the **Execute** button to start the test.

Step 5: Check the test result:

- Accept : OK
- Result : OK
- Received frame length : 516
- Transmission time : The result will vary depending on the distance.

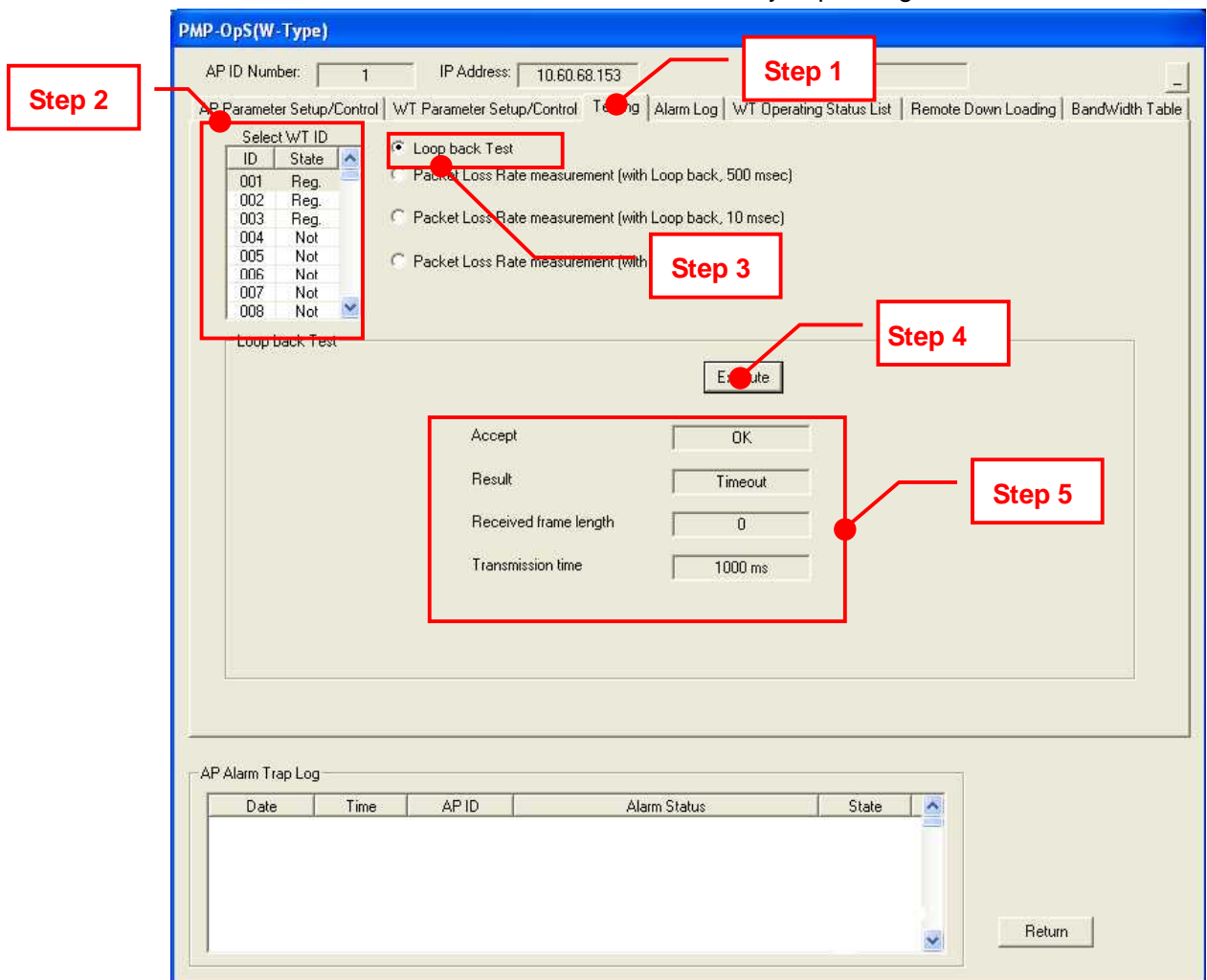


Figure 6-54 Perform a continuity test

6.13.2. Measure the packet loss rate

Connect the OpS terminal to an AP and measure the packet loss rate with the following procedure:

Step 1: Click the Testing tab.

Step 2: Select a WT from the Select WT ID list.

Step 3: Select the "Packet Loss Rate measurement (with Loop back, 10msec)" check box.

Step 4: Specify the following settings, and click the Execute button to start the test.

- Display Interval : 4 seconds
- Modulation Method (only Adaptive) : Select the current modulation method (check the WT Operation Status List in the OpS).
- Retry Time : 5 minutes

Step 5: Perform a time measurement and check the Packet Loss Rate column.

The screenshot shows the 'Testing' tab in the AP configuration interface. The 'Packet Loss Rate measurement (with Loop back, 10 msec)' option is selected. The settings are: Display Interval: 4 seconds, Modulation Method: 16QAM, and Retry Time: 5 minutes. The 'Execute' button is visible. Below the settings, there are two tables showing measurement results for AP and WT.

Time	Trans. Level dBm	Rec. Level dBm	BER	Packet Loss Rate	Ether Tx Packets	Ether Tx Loss Packets	Ether Rx Packets	Ether Rx Loss Packets
2005/09/24 15:33:59	14.0	-61.5	0.000000e-000	0.000000e-000	3069	0	3069	0
2005/09/24 15:34:03	14.0	-61.5	0.000000e-000	0.000000e-000	3473	0	3473	0
2005/09/24 15:34:07	14.0	-61.5	0.000000e-000	0.000000e-000	3877	0	3877	0
2005/09/24 15:34:10	14.0	-61.5	0.000000e-000	0.000000e-000	4281	0	4281	0
2005/09/24 15:34:14	14.0	-61.5	0.000000e-000	0.000000e-000	4685	0	4685	0
2005/09/24 15:34:19	14.0	-61.5	0.000000e-000	0.000000e-000	5089	0	5089	0

Time	Trans. Level dBm	Rec. Level dBm	BER	Packet Loss Rate	Ether Tx Packets	Ether Tx Loss Packets	Ether Rx Packets	Ether Rx Loss Packets
2005/09/24 15:33:59	14.0	-63.5	2.663125e-006	0.000000e-004	0	0	0	0
2005/09/24 15:34:03	14.0	-63.0	2.510143e-006	0.000000e-004	0	0	0	0
2005/09/24 15:34:07	14.0	-63.0	2.623270e-006	0.000000e-004	0	0	0	0
2005/09/24 15:34:10	14.0	-63.0	2.778676e-006	0.000000e-004	0	0	0	0
2005/09/24 15:34:14	14.0	-62.5	2.868511e-006	0.000000e-004	0	0	0	0
2005/09/24 15:34:19	14.0	-63.0	2.854808e-006	0.000000e-004	0	0	0	0

Figure 6-55 Measure the packet loss rate

6.14. Check sheet of WT Construction

Check the operation of the WT using the check sheet below.

Test procedure

(A) LED operation test

- Remove the AC adapter (to turn off the power) and make sure that all the LEDs are off.
- Insert the AC adapter (to turn on the power) and check the states of the LEDs.

(B) Loopback test between the WT and the WT adapter

- Press the TEST switch on the WT adapter and make sure that the ETHER LED goes out.
- Remove the cable from the WT adapter's PC port and make sure that the ETHER LED goes out.

(C) Receive level

- Connect the WT Local Management Tool to the WT and measure the receive level.

(D) Position of the AP-RFU in the field of view after direction adjustment

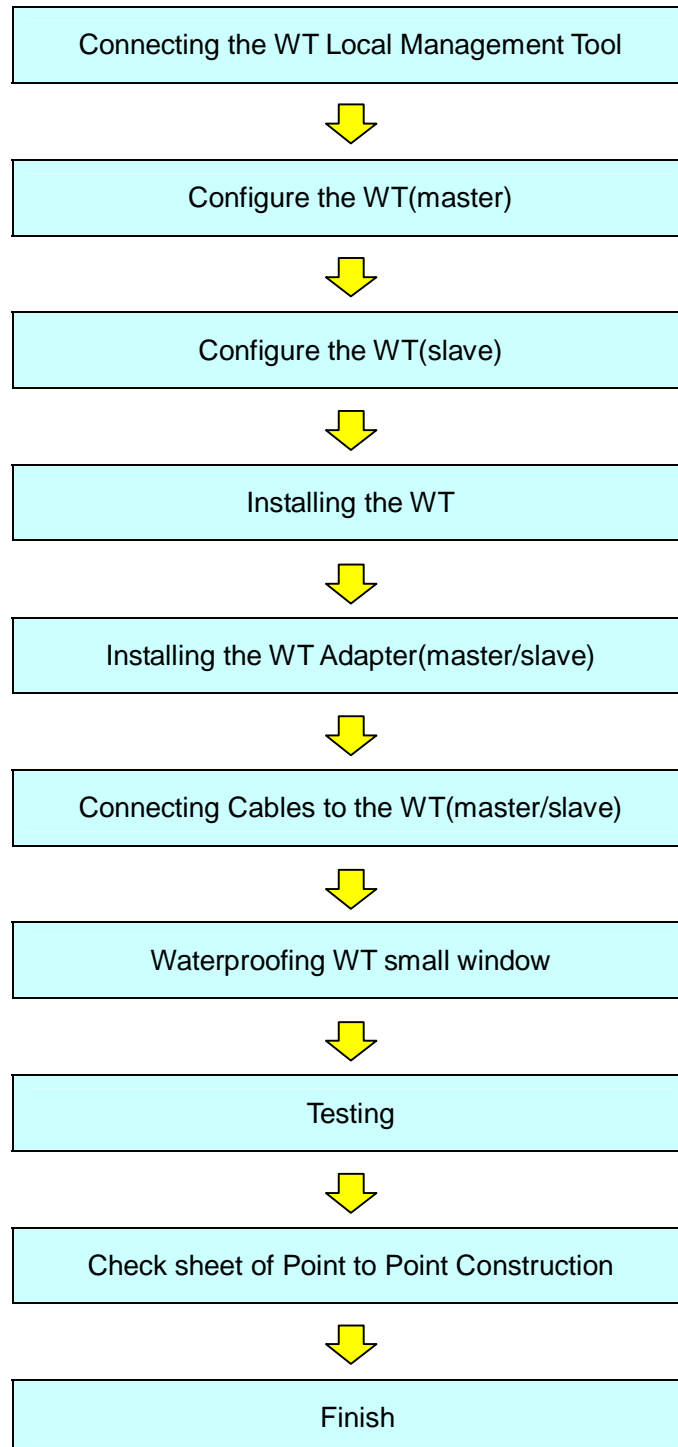
- After the direction is adjusted, look into the scope of the Antenna direction adjustment tool to visually check the position of the AP-RFU

Table 6-1 Check sheet

WT	Serial number		Test date		
Test type	Test condition	Check item		Pass/fail	Measured value
LED operation test	Remove the AC adapter.	Confirm that the POW LED on the WT adapter goes out.			-
		Confirm that the ETHER LED on the WT adapter goes out.			-
		Confirm that the ALM LED on the WT adapter goes out.			-
	Insert the AC adapter.	Confirm that the POW LED on the WT adapter lights green.			
		Confirm that the ETHER LED on the WT adapter flashes green.			
		Confirm that the ALM LED on the WT adapter flashes at 1-second intervals and then goes out.			
Loopback test between WT and WT adapter	Press the TEST switch on the WT adapter.	Confirm that the ETHER LED on the WT adapter goes out.			-
	Remove the cable from the WT adapter's PC port.	Confirm that the ETHER LED on the WT adapter goes out.			
Receive level	-	Connect the WT Local Management Tool to the WT and measure the receive level.			dBm

7. CONSTRUCTING A POINT-TO-POINT SYSTEM

7.1. Overview(WT Construction flow)



7.2. Connecting the WT Local Management Tool

Connect the local management tool terminal to the PC port of the WT adapter (Figure 7-1) using a straight Ethernet cable.

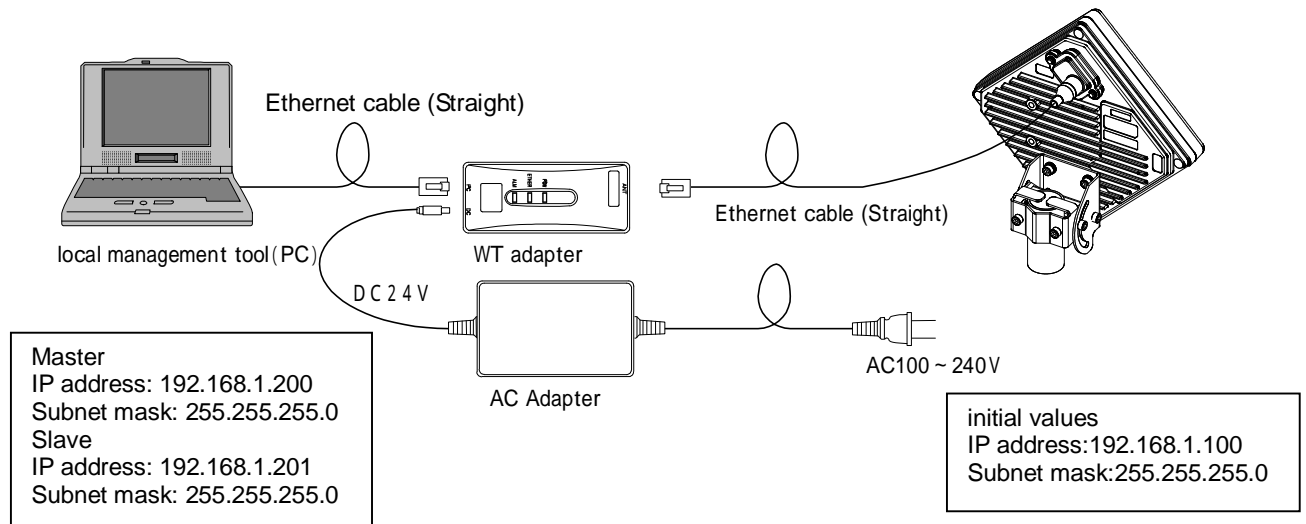


Figure 7-1 Connection



- When changing the IP address of the unit, set the IP address of the local management tool (PC) to an IP address belonging to the same network.
- When changing the IP address of the unit, restart the power of the hub if the unit is connected to the local management tool (PC) via a hub (because MAC address learning may fail and the connection may be dropped).

7.3. Configure the WT(master)

Change the WT's mode from P-MP to P-P(matser).

On the Setup screen in the WT Local Management Tool (Master in P-P mode, Administrator), specify the settings in the following procedure:

Step 1: Select the "Master" setup tab.

Step 2: Specify the settings under Setup for Setup Parameters.

- System ID Number: Set the system ID number.
- Serial number at opposite WT: Set the serial number at the opposite WT.
- Encryption Parameter: Set the encryption parameter.
- Trans. Level: Set the transmission level.
- Modulation Method: Set the modulation method to QPSK, 16QAM, or AUTO.
- Interface Class: Set the interface class to AUTO or 10BASE.
- Radio Frequency: Set the radio frequency.
- Reg. Status: Set the registration status to Reg.

Step 3: Set the Network configuration for Setup Parameters.

- IP Address: Set the IP address.
- Subnet mask: Set the subnet mask.
- Default gateway: Set the default gateway.
- Trap Des. IP Add1: Set "Reg." or "Not" and trap destination IP address 1. As required, you can also set Trap Des. IP Add2, and Trap Des. IP Add3.
- OpS Frame Priority: Set the OpS frame priority.
- OpS Frame Vlan-ID: Set the OpS frame Vlan-ID.
- ARP Request: Set the ARP request to ON or OFF.

Step 4: Click the **Setup** button.

Step 5 Make a clock setting in Setup Parameters2 and click the **Setup** button.

Step 6 Set RFU Transmission (Enable) in Setup Parameters3 and click the **Execute** button.

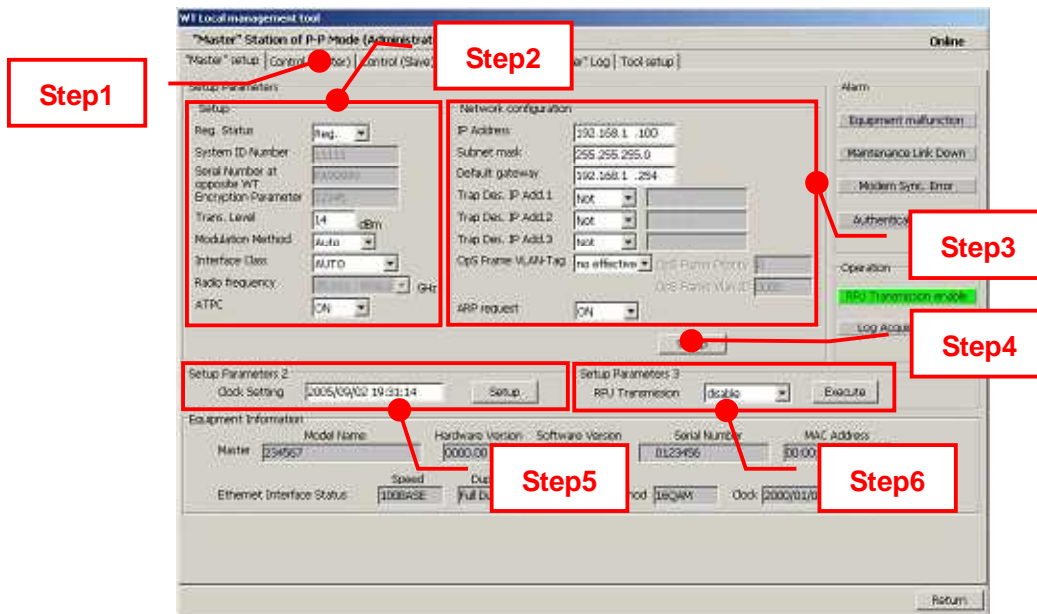


Figure 7-2 Configure the WT(master)

7.4. Configure the WT(slave)

Change the WT's mode from P-MP to P-P(slave).

On the Setup screen in the WT Local Management Tool (Slave in P-P mode, Administrator), specify the settings in the following procedure:

Step 1: Select the "Slave" setup tab.

Step 2: Specify the settings under Setup for Setup Parameters.

- System ID Number: Set the system ID number.
- Serial number at opposite WT: Set the serial number at the opposite WT.
- Encryption Parameter: Set the encryption parameter.
- Trans. Level: Set the transmission level.
- Interface Class: Set the interface class to AUTO or 10BASE.
- Radio Frequency: Set the radio frequency.

Step 3: Set the Network configuration for Setup Parameters.

- AP IP Address: Set the AP IP address.
- Subnet mask: Set the subnet mask.
- Default gateway: Set the default gateway.
- ARP Request: Set the ARP request to ON or OFF.

Step 4: Click the **Setup** button.

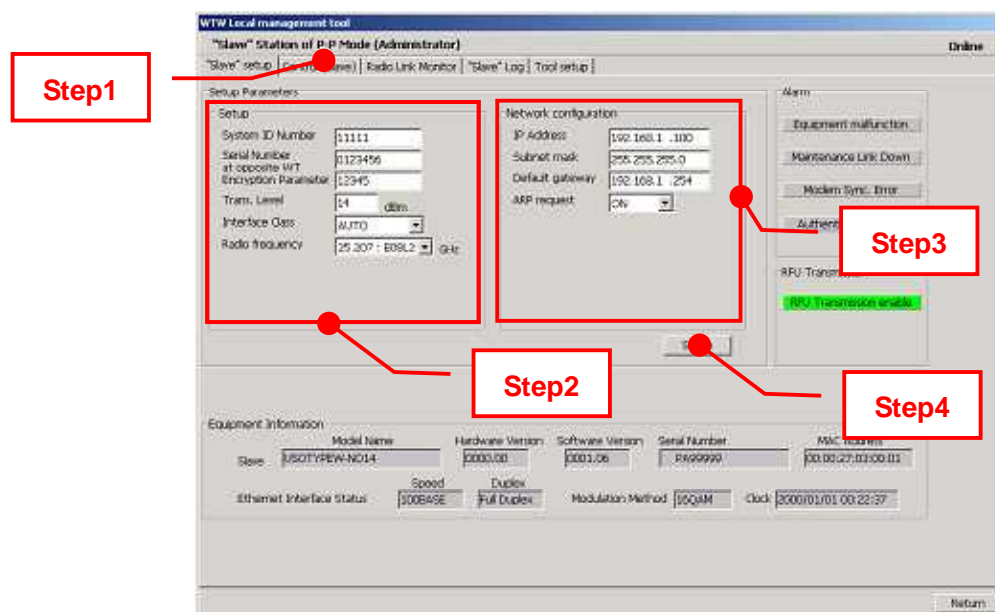


Figure 7-3 Configure the WT(slave)

7.5. Installing the WT

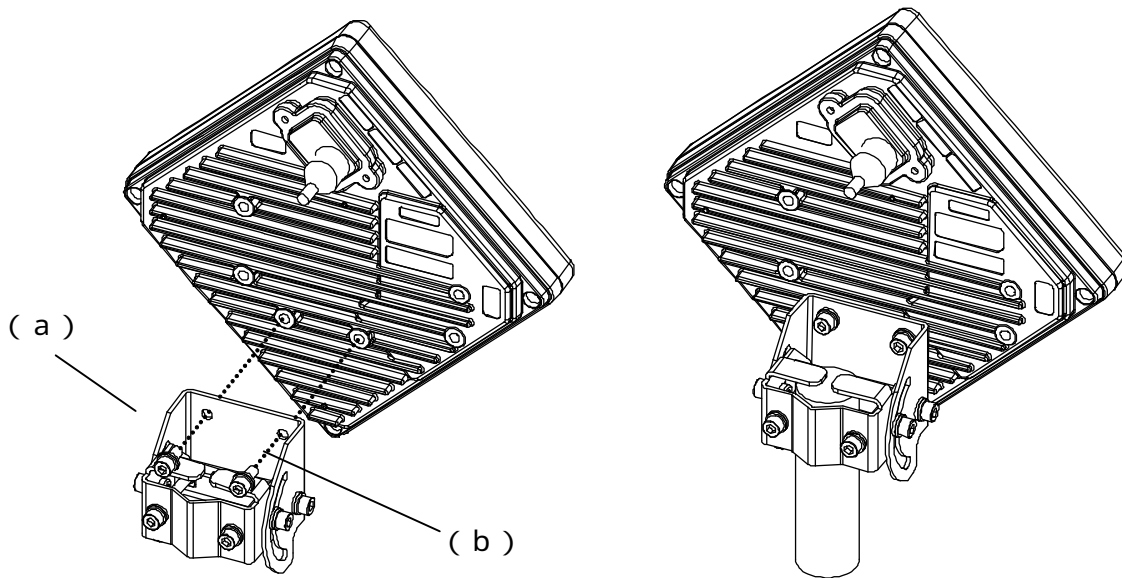
7.5.1. Installing the WT(master/slave)

Step1 Attach the WT mounting bracket to the WT using the bolts(a)and (b).

You can orient the WT either for vertical or horizontal polarization.

Step2 Secure the WT mounting bracket to the pole using the bolts.

Applicable pole diameter: From $\Phi 31.8\text{mm}$ to $\Phi 34\text{mm}$



Fi

Figure 7-4 Installing the WT

A builder prepares a steel pipe by the installation place (a wall, a pole or etc.), and it install.
The required space of installation is shown below.

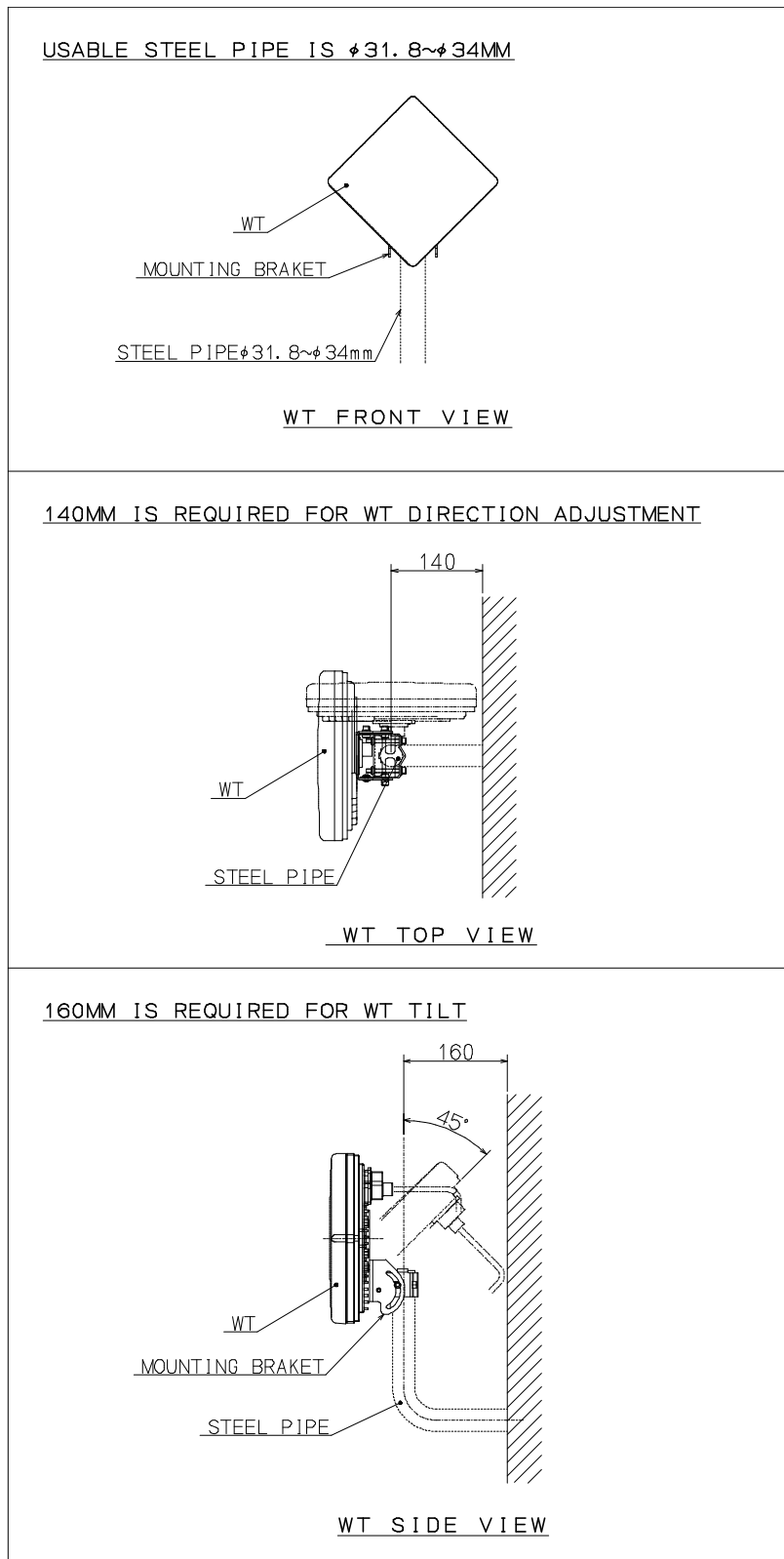


Figure 7-5 The required space of installation

7.5.2.Example of Installing the WT

(1) On a metal fence

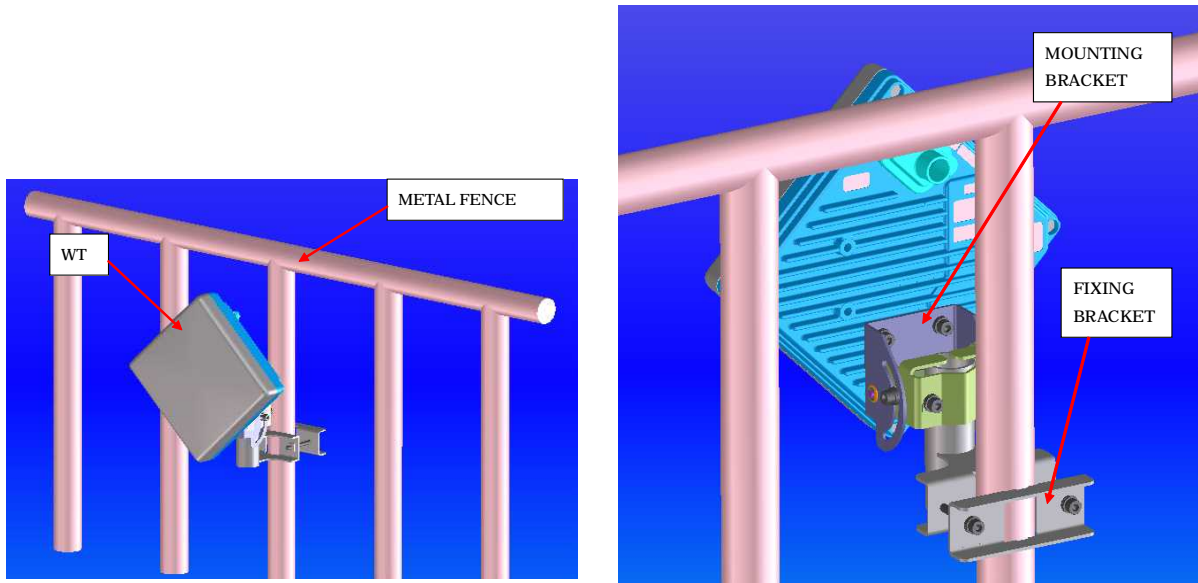


Figure 7-6 Installing on a metal fence

(2) On a house wall

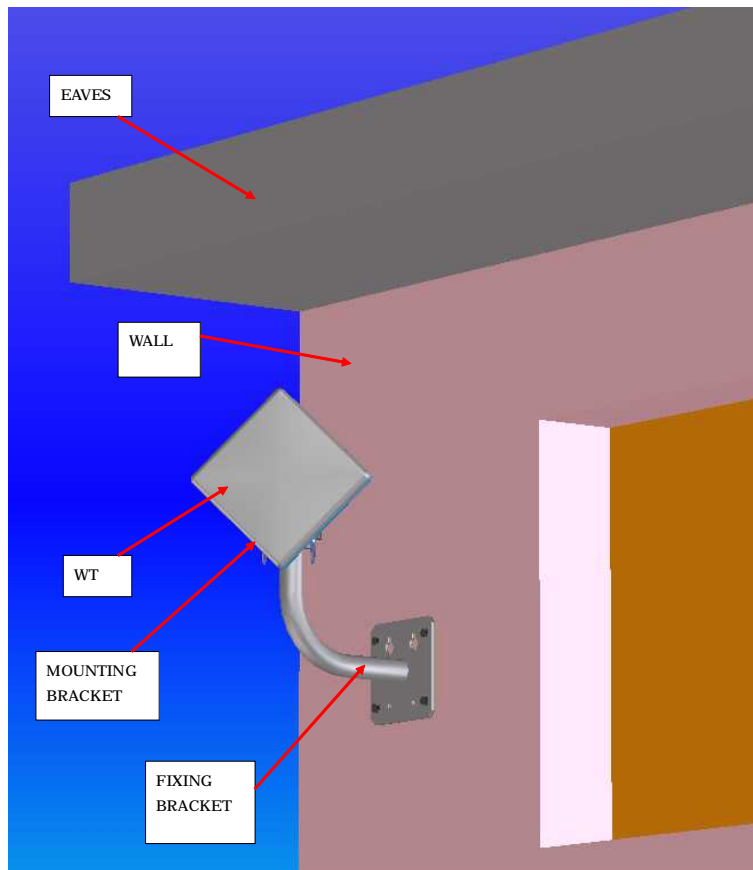


Figure 7-7 Installing on a house wall

7.5.3. Setting the WT for Vertical or Horizontal Polarization

Rotate the antenna ninety degrees to choose between vertical or horizontal polarization

For vertical polarization, position **TOP V** at the top.

For horizontal polarization, position **TOP H** at the top.

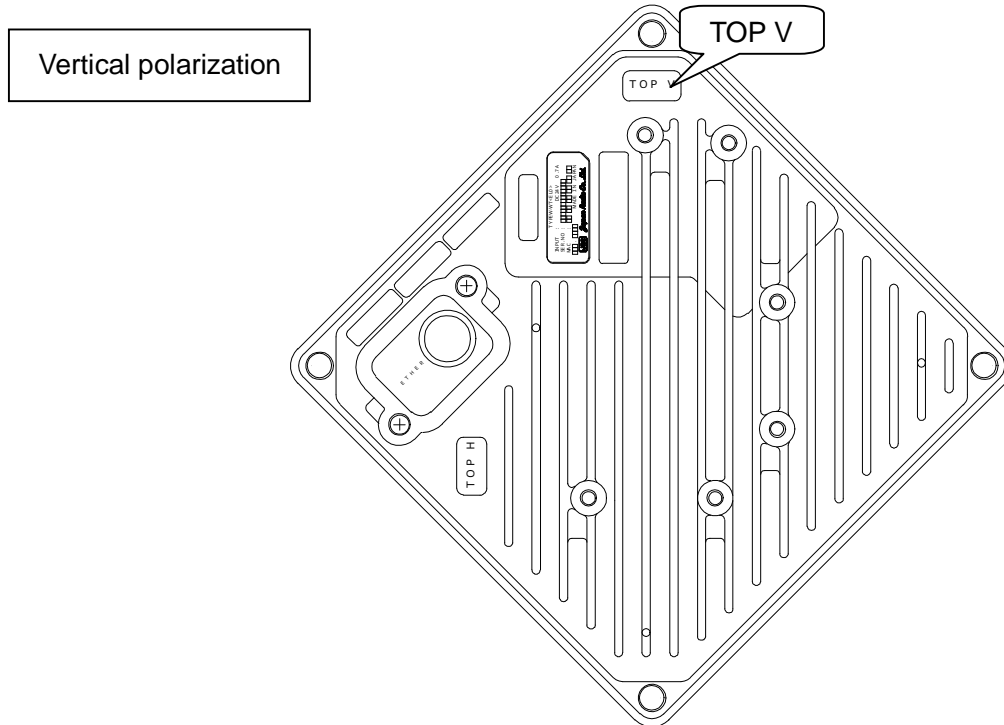


Figure 7-8 Vertical Polarization

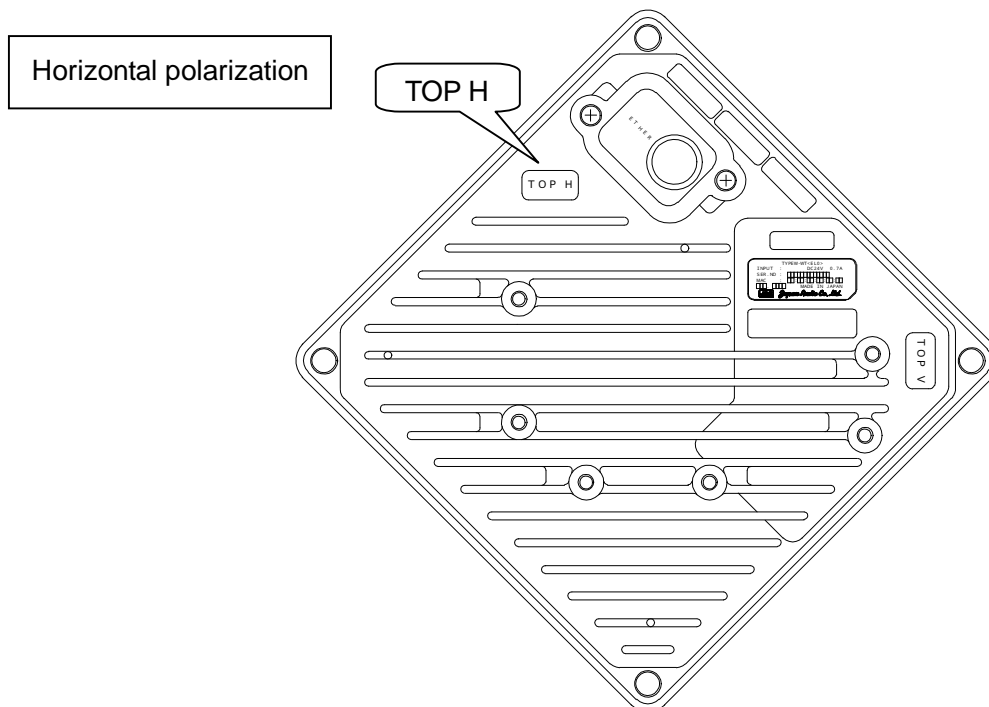


Figure 7-9 Horizontal Polarization

7.6. Installing the WT (External Antenna)

7.6.1. Installing the WT (External 30cm Antenna)

1. Φ30cm antenna installation procedure

1) According to the antenna manual of RADIO WAVES, INC., set it up on the pole. (Figure 7-10)

2) Spread specified grease on the O-ring.
The spreading method depends on the manual. (Figure 7-11)

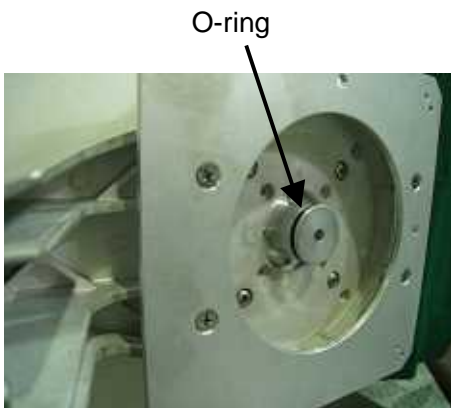


Figure 7-11



Figure 7-10 Φ30cm antenna

2. WT installation procedure

Attach the antenna adaptor to the WT with the O-ring using four M3 screws. (Figure 7-12 & Figure 7-13)

Tightening torque : 57 N·cm

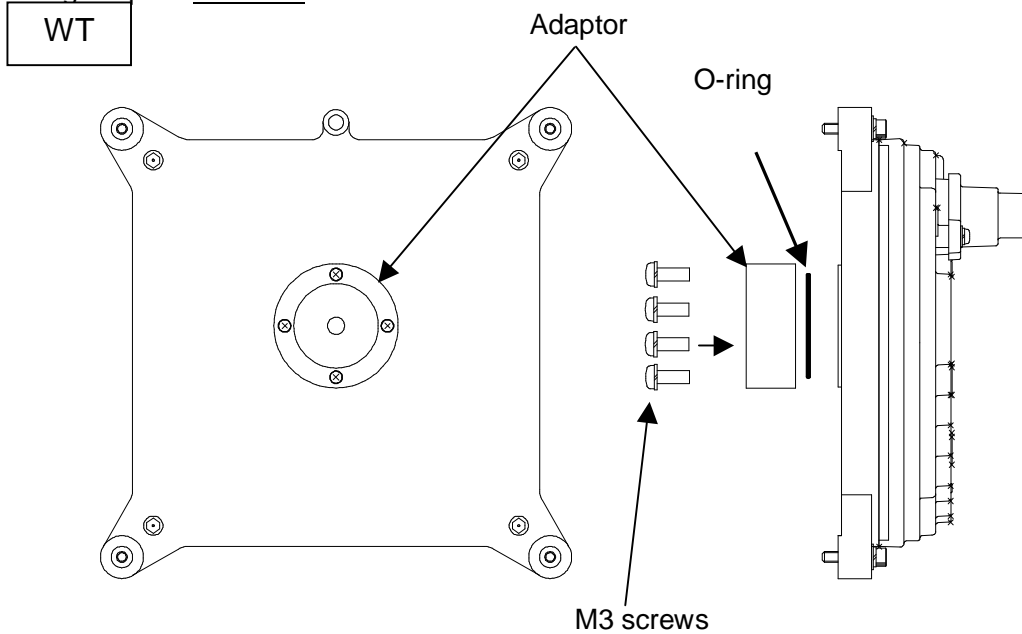
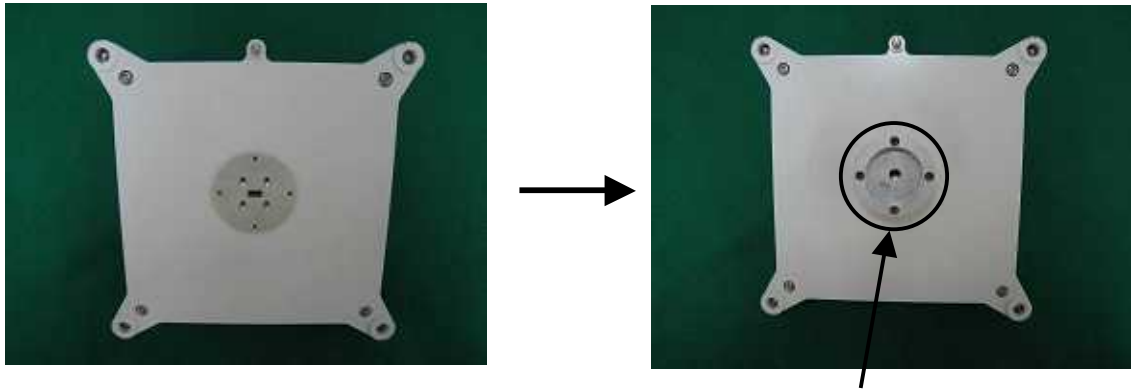


Figure 7-12



After installing the adaptor

Figure 7-13

3. Attachment of the WT to the antenna

1) V(ertical) polarization

When using the V polarization, the guide pin of the WT should be turned to right above and inserted into the V guide hole of the plate. (Figure 7-14 & Figure 7-15)



Guide pin



V polarization

Figure 7-15

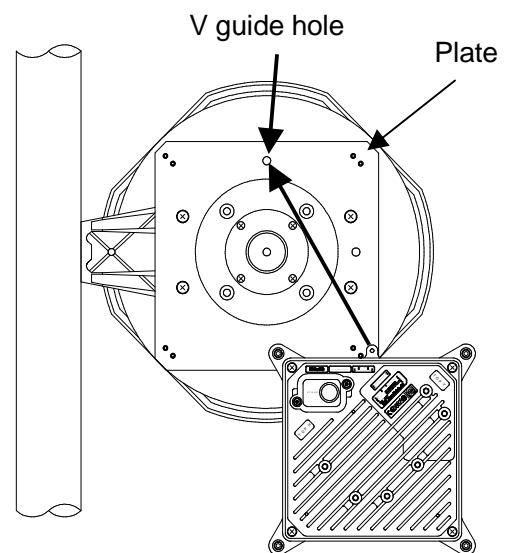


Figure 7-14

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 7-16)

Tightening torque : 265 N·cm

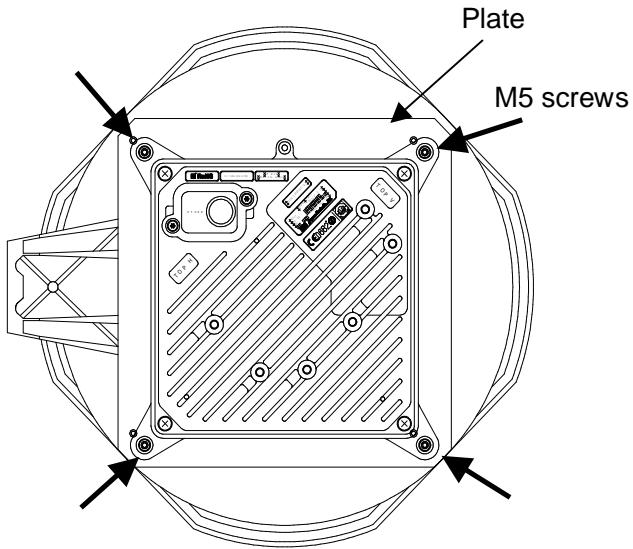


Figure 7-16

2) H(orizontal) polarization

When using H polarization, the guide pin of the WT should be rotated to the right and inserted into the H guide hole of the plate. (Figure 7-17 & Figure 7-18)



Figure 7-17

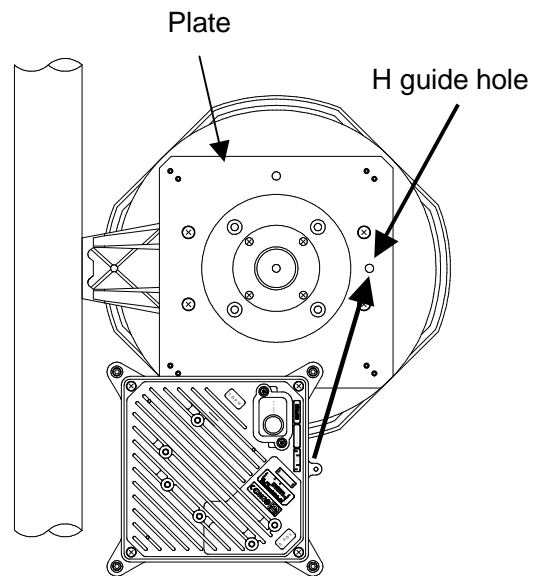


Figure 7-18

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 7-19)
Tightening torque : 265 N·cm

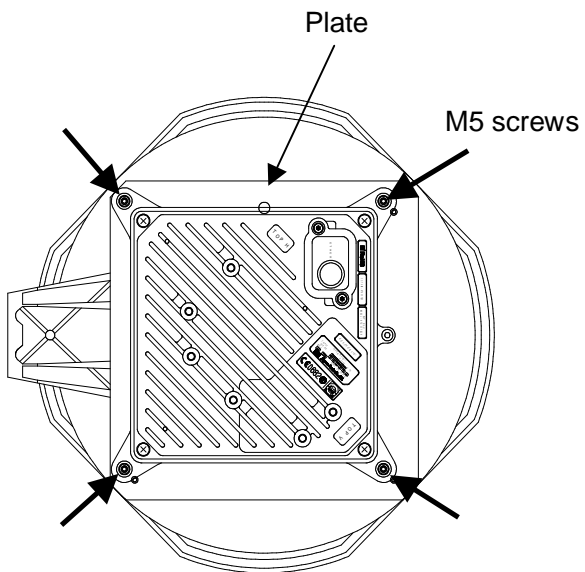


Figure 7-19

7.6.2. Installing the WT (External 60cm Antenna)

1. Φ60cm antenna installation procedure

1) According to the antenna manual of RADIO WAVES, INC., set it up on the pole. (Figure 7-20)

2) Spread specified grease on the O-ring.
The spreading method depends on the manual. (Figure 7-21)

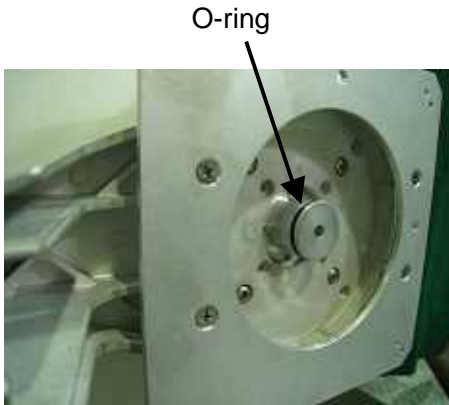


Figure 7-21



Figure 7-20 Φ30cm antenna

2. WT installation procedure

Attach the antenna adaptor to the WT with the O-ring using four M3 screws. (Figure 7-22 & Figure 7-23)

Tightening torque : 57 N·cm

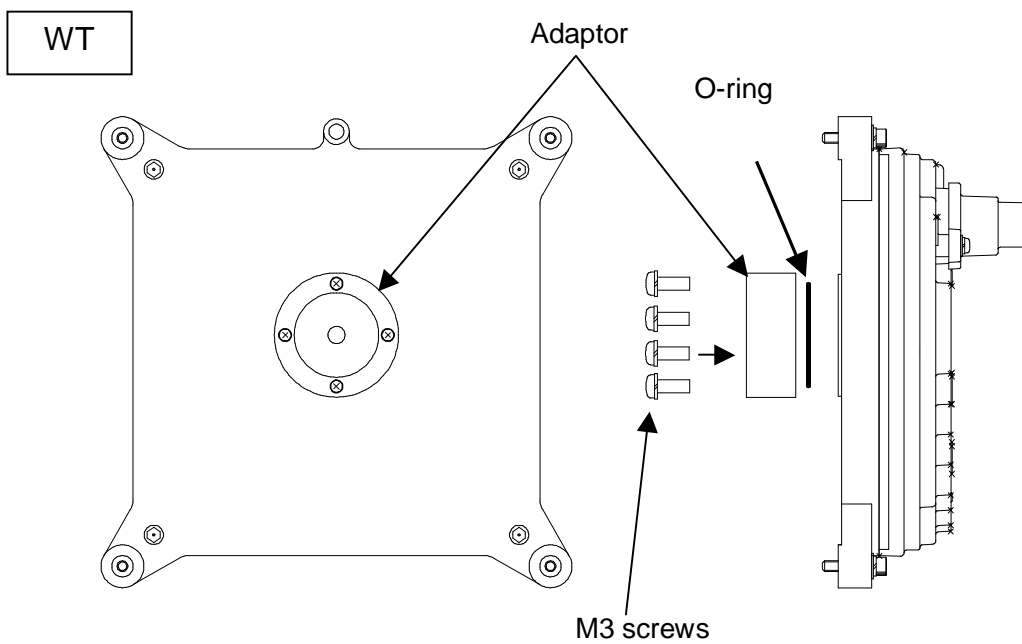
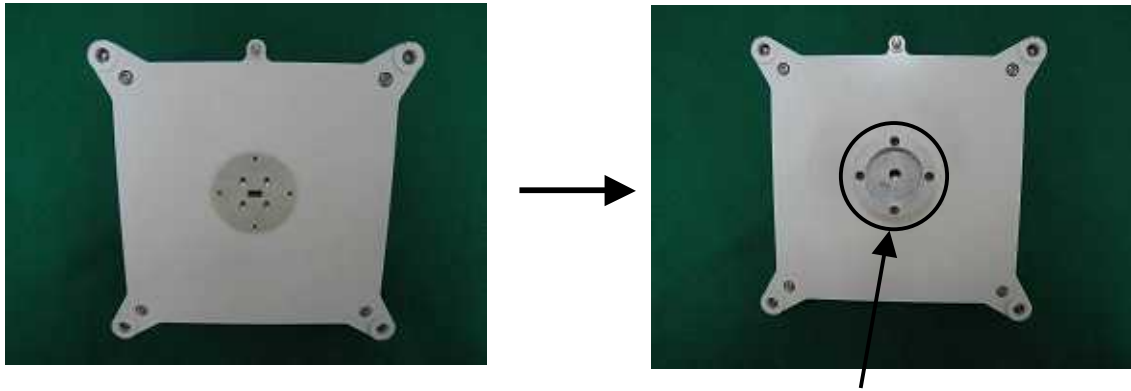


Figure 7-22



After installing the adaptor

Figure 7-23

3. Attachment of the WT to the antenna

1) V(ertical) polarization

When using the V polarization, the guide pin of the WT should be turned to right above and inserted into the V guide hole of the plate. (Figure 7-24 & Figure 7-25)



Guide pin



V polarization

Figure 7-25

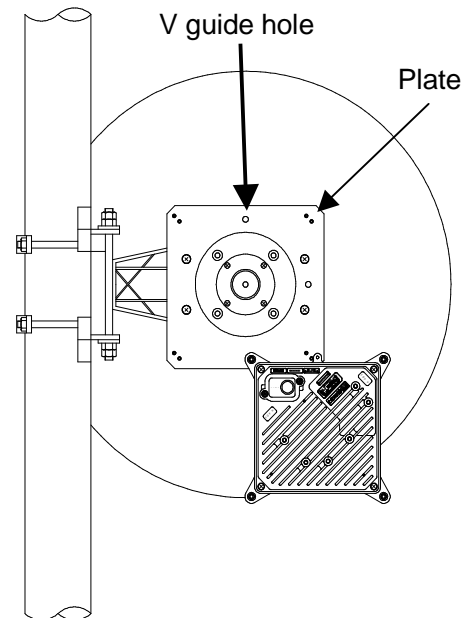


Figure 7-24

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 7-26)

Tightening torque : 265 N·cm

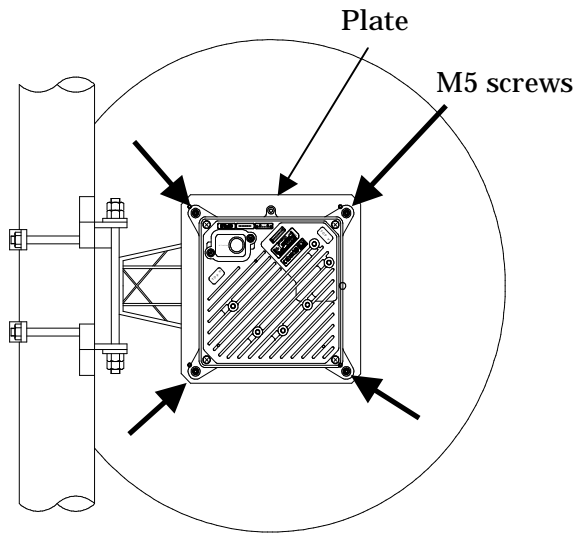


Figure 7-26

2) H(orizontal) polarization

When using H polarization, the guide pin of the WT should be rotated to the right and inserted into the H guide hole of the plate. (Figure 7-27 & Figure 7-28)



Figure 7-27

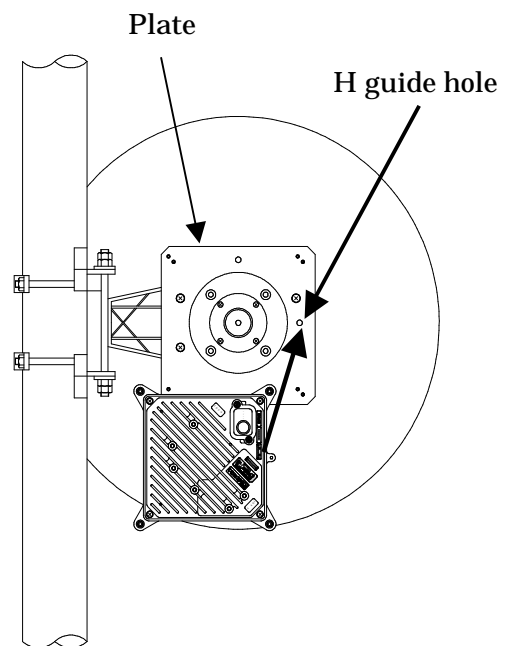


Figure 7-28

After inserting the guide pin of the WT into the guide hole, presses the WT to the plate.
While you are pressing the WT, you must be tightening the four M5 screws. (Figure 7-29)
Tightening torque : 265 N·cm

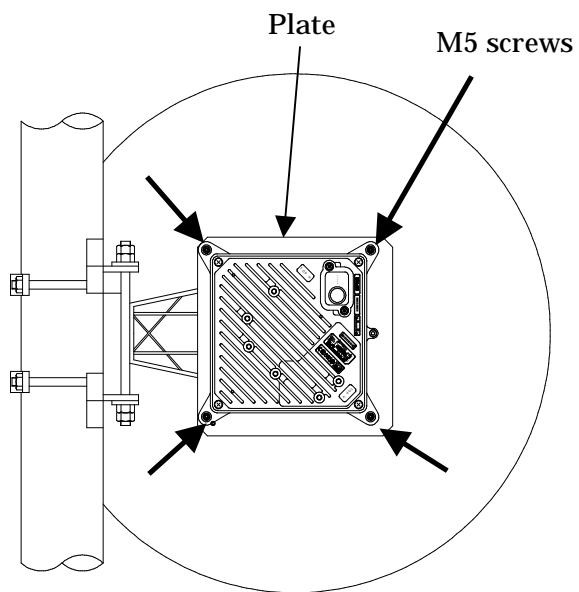


Figure 7-29

7.7. Adjusting the Direction of the WT

7.7.1. Adjusting the Direction of the WT

This section describes the procedure for adjusting the antenna direction when a Point-to-Point System is used.

When adjusting the direction of the WT antenna, use the “Antenna direction adjustment tool” together with the WT Local Management Tool.

Step 1: Connection between WT (master/slave) and WT Local Management Tool and display the Receiving Level.

See Subsection 7.7.1.1

- Method of adjustment for near-distance installation

If circuit design calls for a receive level of -35 dBm or higher, you need to reduce the transmission level according to the following procedure:

WT (Master) Trans Level : 14dBm → -6dBm (see Subsection 7.7.1.1 (4))

WT (Slave) Trans Level : 14dBm → -6dBm (see Subsection 7.7.1.1 (4))

Step 2: Rough adjustment for the WT (Master)

- Install the Antenna direction adjustment tool.
- See Subsection 7.7.1.2
- Remove the Antenna direction adjustment tool.

Step 3: Rough adjustment for the WT (Slave)

- Install the Antenna direction adjustment tool.
- See Subsection 7.7.1.2
- Remove the Antenna direction adjustment tool.

Step 4: Fine adjustment for the WT (Slave)

- See Subsection 7.7.1.3

Step 5: Fine adjustment for the WT (Master)

- See Subsection 7.7.1.3

Step 6: Verification

- After fine adjustment, use the WT Local Management Tool to final check the receive level. If the receive level value is within the standard range, the procedure for adjusting the antenna direction has been completed.
If the receive level value is lower than a standard value, you need to perform Steps 4 and 5 again.

Step 7: Exit the WT Local Management Tool, and remove the cable from the WT adapter.

7.7.1.1. Connecting the WT Local Management Tool

(1) As shown in Figure 7-30, connect the WT Local Management Tool (PC) to the WT adapter.

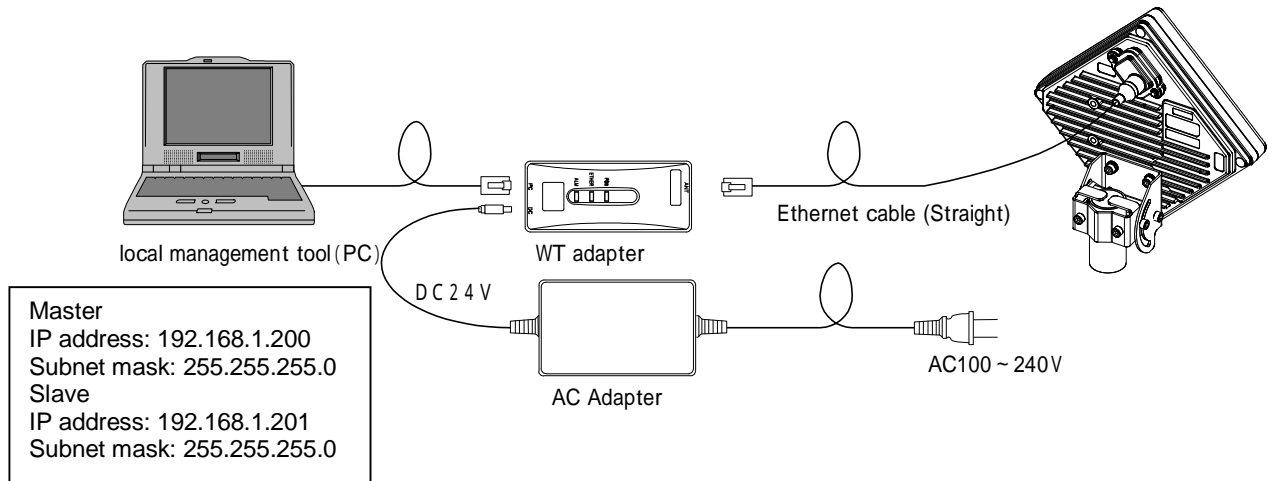


Figure 7-30 Connecting the WT Local Management Tool

(2) Measuring the receive level the WT (master in P-P mode)

- Start the WT Local Management Tool and select P-P mode.
- On the Radio Link Monitor screen in the master station in P-P mode, measure the "Receiving Level" value.

The procedure is shown in Figure 7-31.

! • The minimum display interval is 1 second, and you need to adjust the antenna direction slowly.

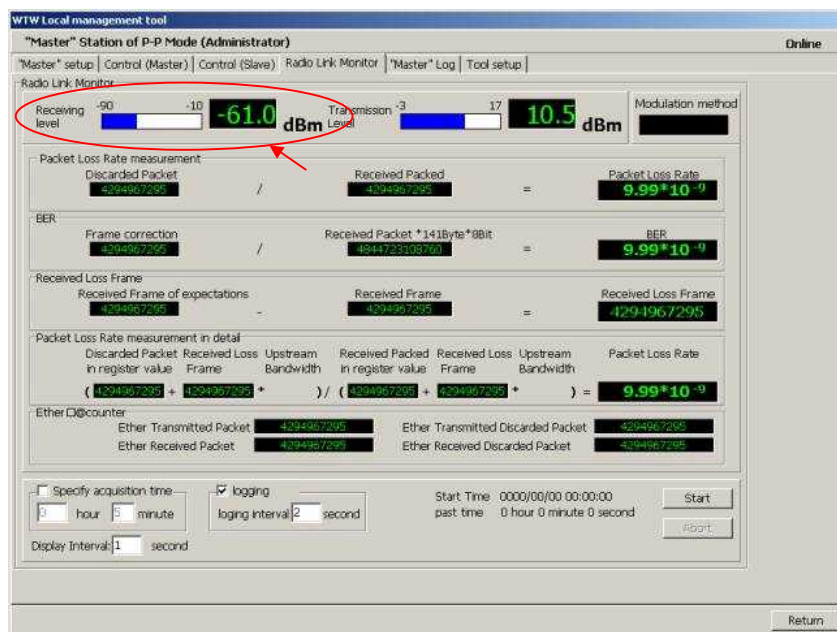


Figure 7-31 Measuring the Receive Level (Master)

(3) Measuring the receive level of the WT (slave in P-P mode)

- Start the WT (slave in P-P mode) and select P-P mode.
- On the Radio Link Monitor screen in the slave station in P-P mode, measure the "Receiving Level" value.

The procedure is shown in Figure 7-32.

! • The minimum display interval is 1 second, and you need to adjust the antenna direction slowly.

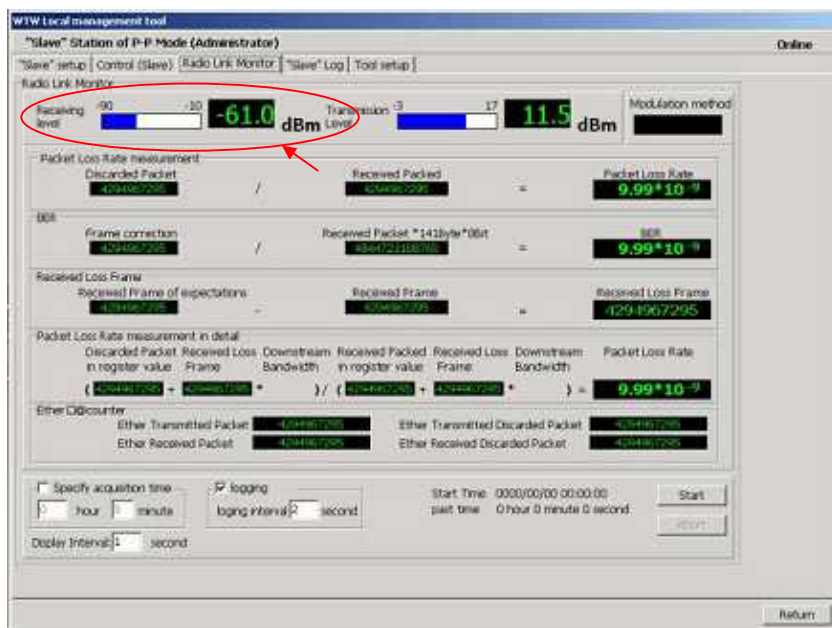


Figure 7-32 Measuring the Receive Level (Slave)

(4) Method of adjustment for near-distance installation

If circuit design calls for a receive level of -35 dBm or higher, use the following procedure:

- Start the WT Local Management Tool and select P-P mode.
- On the Master Setup screen in the master station in P-P mode, change "Trans.Level" from 14[dBm] to -6[dBm]. After the change, click the SETUP button.

The procedure is shown in Figure 7-33.

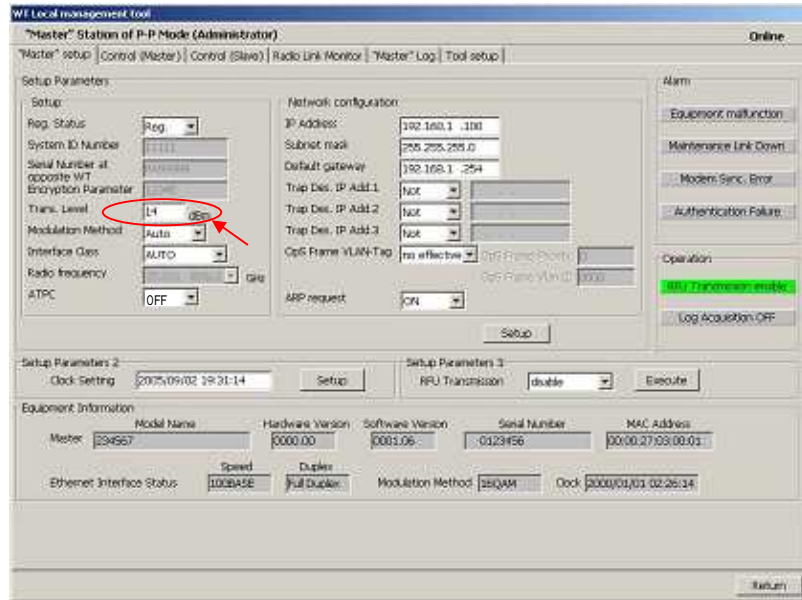


Figure 7-33 Setting "Trans.Level" for the WT (Master)

- On the Slave Setup screen in the slave station in P-P mode, change "Trans.Level" from 14[dBm] to -6[dBm]. After the change, click the SETUP button.

The procedure is shown in Figure 7-34.

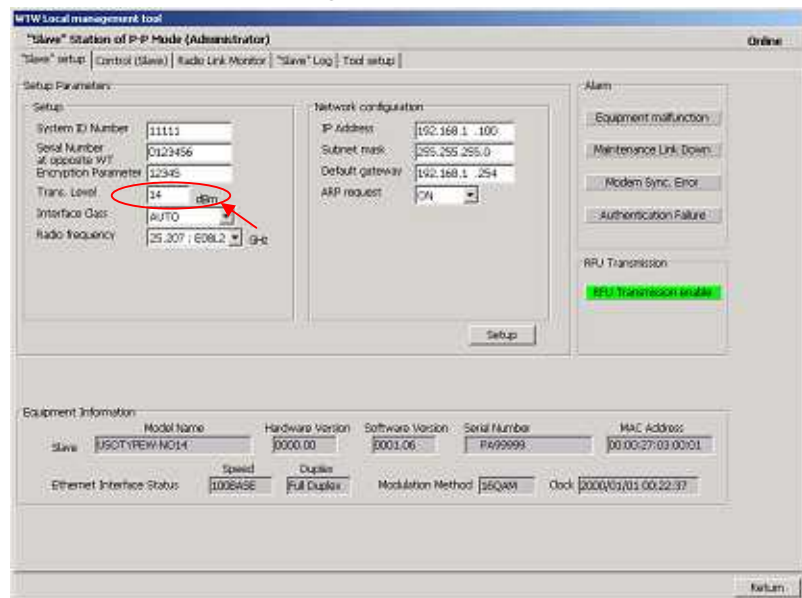


Figure 7-34 Setting "Trans.Level" for the WT (Slave)

7.7.1.2. Roughly Adjusting the Direction

- Step1 As shown in Figure 7-35 and Figure 7-36, use the wing bolt (a) to attach the Antenna direction adjustment tool.
- Step2 As shown in Figure 7-37, loosen the hexagonal socket head bolts (b) and (c) securing the mounting bracket and swing the antenna left or right. Adjust the antenna approximately for the WT direction and finger-tighten the bolts (b) and (c).
- Step3 As shown in Figure 7-38, loosen the bolts (d), (e), and (f) and tilt the antenna up or down. Perform vertical-direction adjustment so that the WT of the opposite station can be seen through the scope of the Antenna direction adjustment tool.

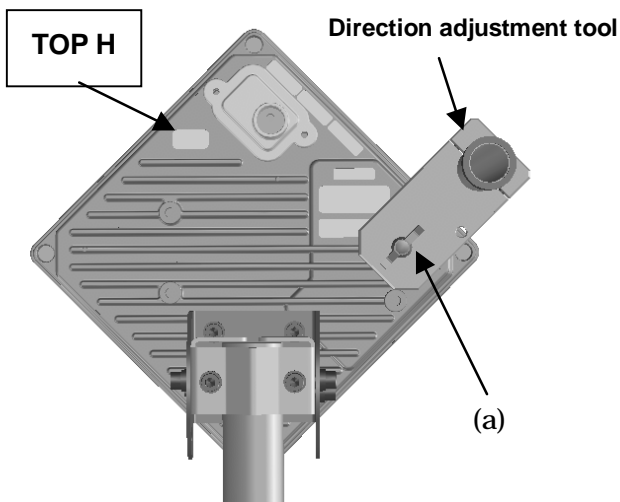


Figure 7-35 How to Install Direction Adjustment tool when the antenna type is the horizontal polarization

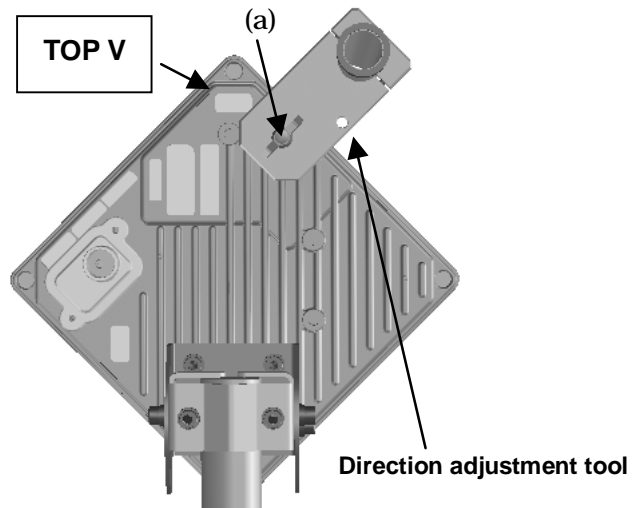


Figure 7-36 How to Install Direction Adjustment tool when the antenna type is the vertical polarization

In Figure 7-37 and Figure 7-38 is an example when the antenna type is the horizontal polarization.

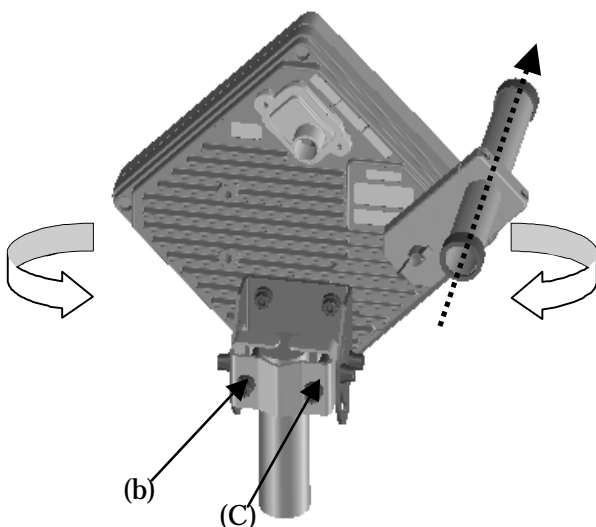


Figure 7-37 Rough-adjusting Horizontal Direction

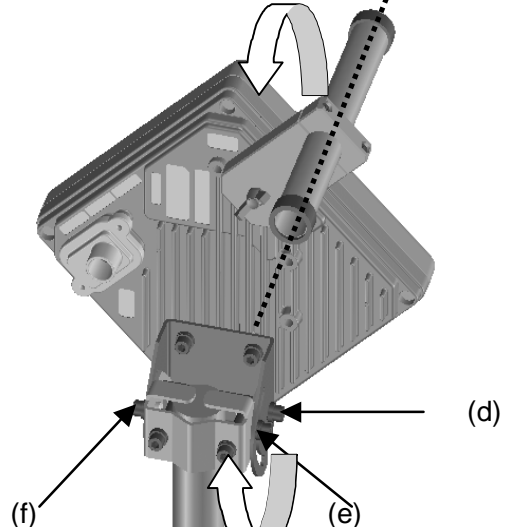


Figure 7-38 Rough-Adjusting the Vertical Direction

! • Never look at the sun directly. Doing so may seriously damage the eyes.

7.7.1.3. Finely Adjusting the Direction

Step 1: Horizontal direction

As shown in Figure 7-39, loosen the hexagonal socket head bolts (a) and (b) securing the mounting bracket and swing the antenna left or right. Adjust the antenna direction so that the receive level indicates the maximum value, and finger-tighten the bolts (a) and (b).

Step 2: Vertical direction

As shown in Figure 7-40, loosen the hexagonal socket head bolts (c), (d), and (e) securing the mounting bracket and tilt the antenna up or down. Adjust the antenna direction so that the receive level indicates the maximum value. Tighten the bolts at a point showing the maximum receive level (tightening torque: 8.5N•m). Tighten the bolts (c), (d), and (e) and make sure that the point showing the maximum receive level is maintained. This concludes the procedure for vertical-direction adjustment.

Step 3: Horizontal direction

Finely adjust the horizontal direction by slightly loosening the bolts (a) and (b) again. Once again, locate the point where the receive level reaches the maximum value and hold that point. Finally, tighten the bolts (a) and (b) (tightening torque: 8.5N•m) while making sure that the point showing the maximum receive level is maintained. This concludes the procedure for horizontal-direction adjustment.

The figures show examples of horizontal polarization setup.

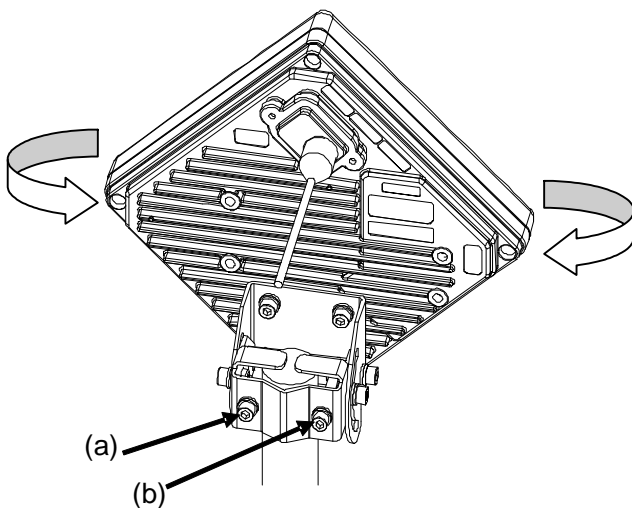


Figure 7-39 Finely Adjusting the Horizontal Direction

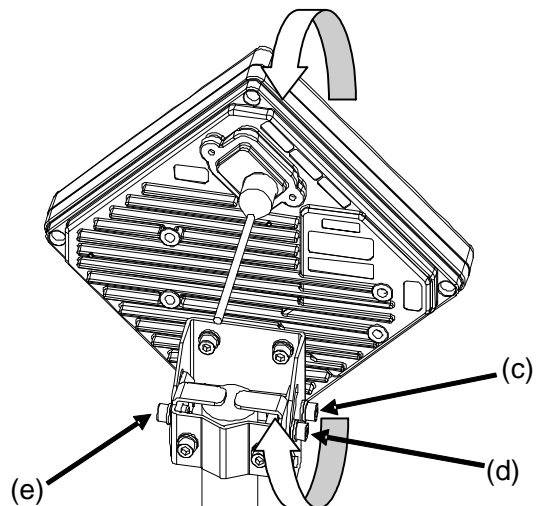


Figure 7-40 Finely Adjusting the Vertical Direction

Note : When adjusting the antenna direction
When adjusting the direction, you might mistakenly take the antenna's side lobe as the maximum receive level. For fine adjustment, therefore, you should move the antenna some more after the receive level has reached the maximum value to make sure that you have not caught a side lobe.

7.7.2. The receive level and the distance

In a point-to-point system, the receiving level at clear sky and the distance are related as shown in Figure 7-41.

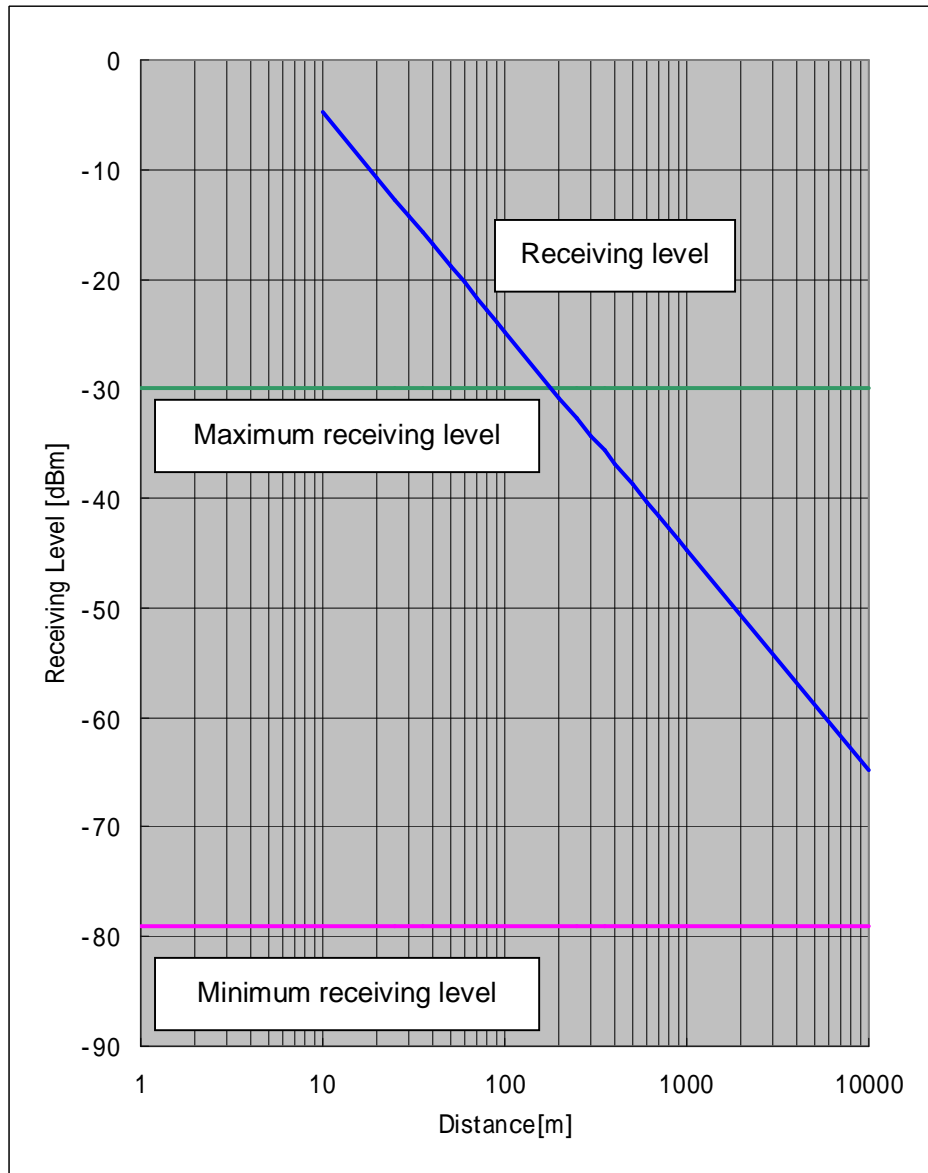


Figure 7-41 Receiving Level and Distance (QPSK)

Transmission level (QPSK)	14 [dBm]
Frequency	26 [GHz]
Antenna gain[TX+RX]	62 [dBi]
TX WT Antenna Gain:31dBiTYP	
RX WT Antenna Gain:31dBiTYP	

Free space loss L_p [dB]

$$[m] = \frac{c [m]}{f [Hz]}$$

$$L_p = 20 \log \left[\frac{4 d}{\lambda} \right]$$

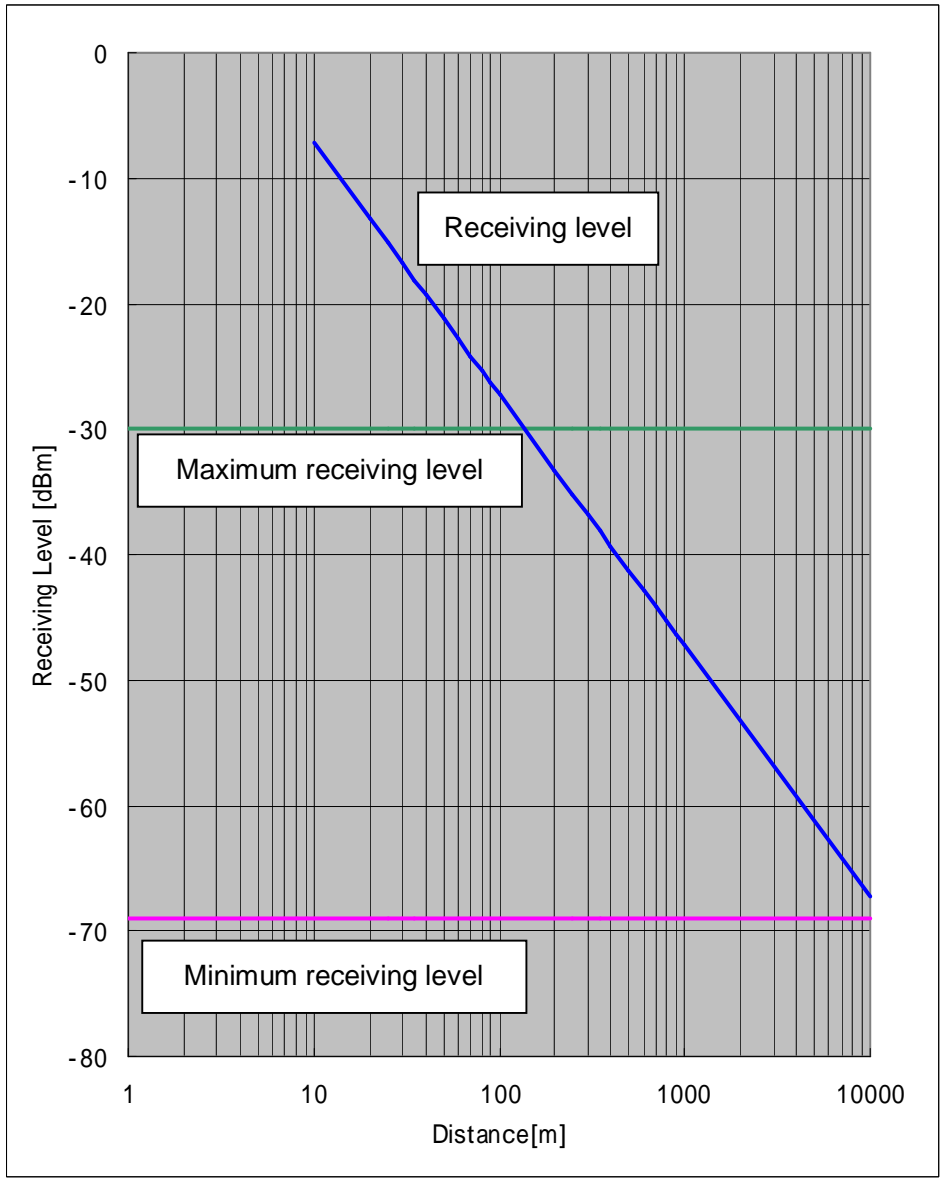


Figure 7-42 Receiving Level and Distance (16QAM)

Transmission level (16QAM)	14	[dBm]
Frequency	26	[GHz]
Antenna gain[TX+RX]	62	[dBi]
TX WT Antenna Gain:31dBi_TYP		
RX WT Antenna Gain:31dBi_TYP		

Free space loss L_p [dB]

$$[m] = \frac{c [m]}{f [Hz]}$$

$$L_p = 20 \log \left[\frac{4}{d} \right]$$

7.8. Installing the WT Adapter(master/slave)

WT Adapter is installed in indoor

It is an example of installing the appended wood screw.

Screw into the mounting position the wood screw that comes with the WT adapter, leaving 2 mm.

Hook the WT adapter on the wood screw.

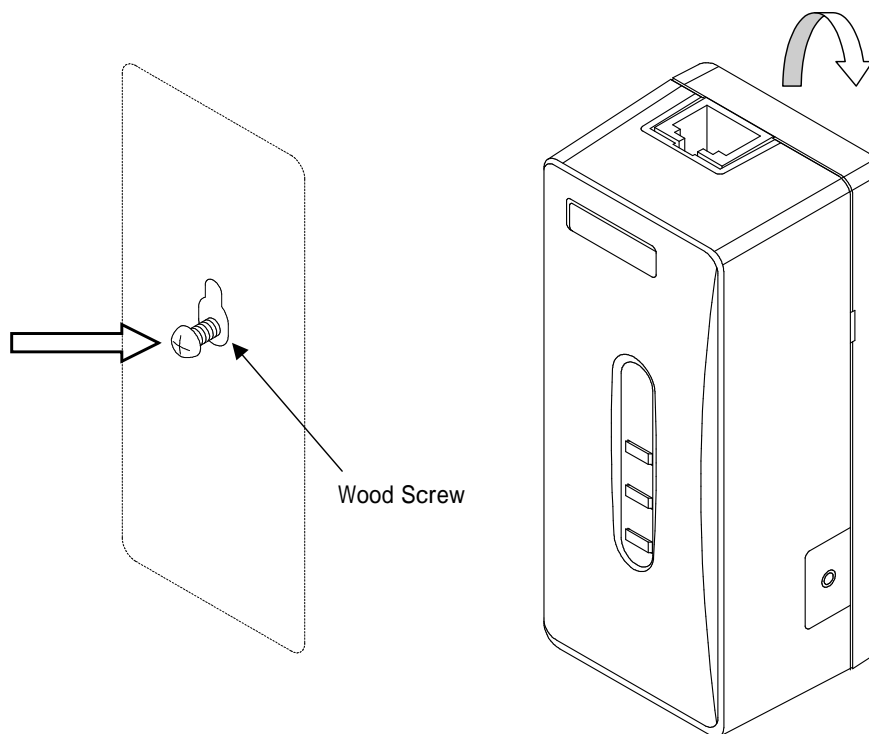


Figure 7-43 Installing the WT Adapter on the Wall

7.9. Connecting Cables to the WT(master/slave)

Use an Ethernet cable (straight) to connect the WT and the WT adapter as shown in Figure 7-44.

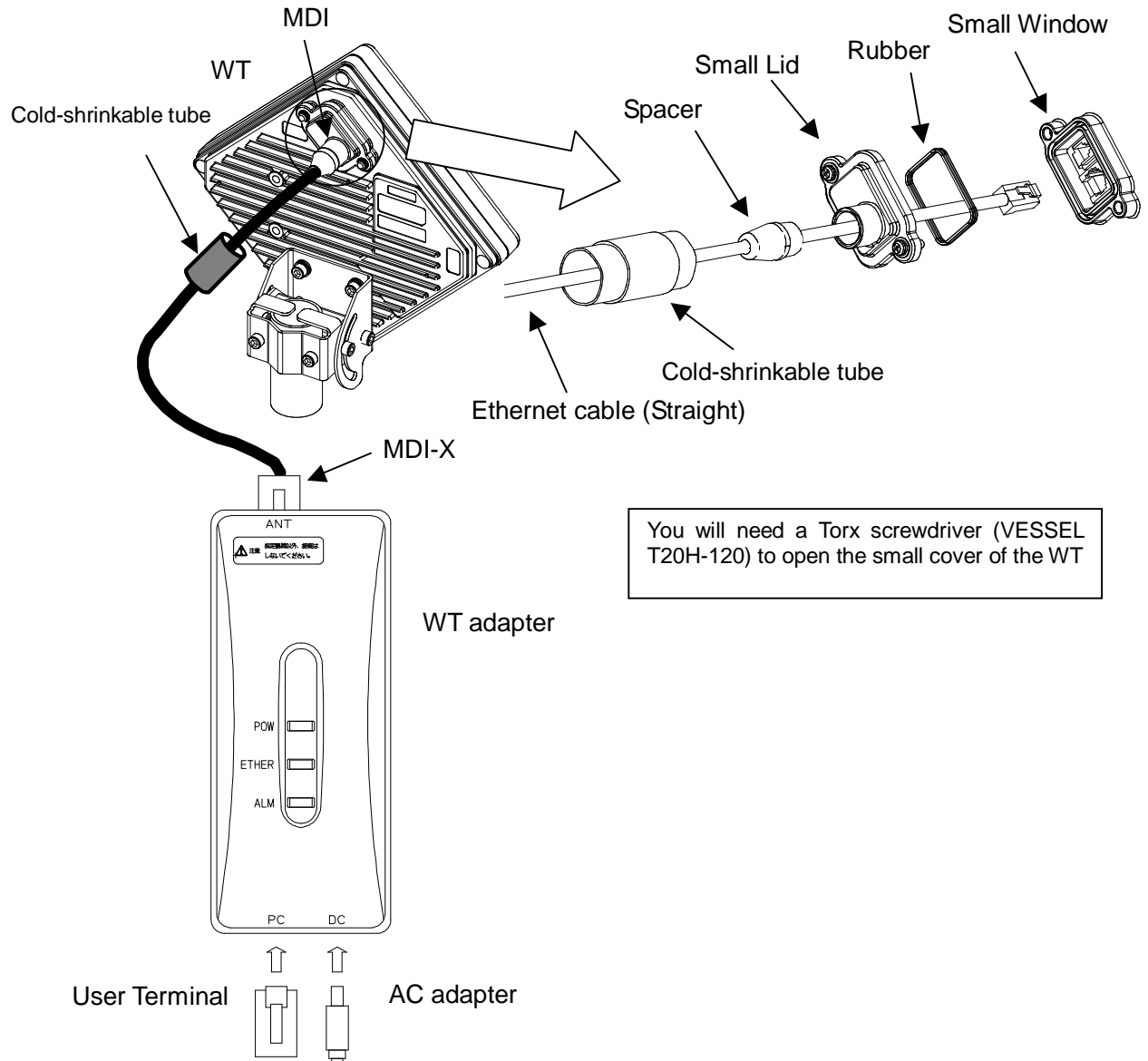


Figure 7-44 Connecting Cables to the WT



(1) Connected cable between WT and ANT port of WT adapter

Cable	
Cable type	Ethernet cable for outdoor, straight
Range of applicable outer diameter	φ5.0 mm ~ 5.7mm
Cable length	50m (maximum)
Connector of both side	
Shape	RJ-45
Cable connection	Straight connection - WT : MDI - ANT port of WT adapter : MDI-X An Ethernet cable has eight signal lines. Four lines are used to carry Ethernet signals. The remaining four lines are used as power lines and LED control lines.

(2) Connect the user terminal to PC port of WT adapter

Interface	
Interface	10BASE-T / 100BASE-TX
Connector	
Shape	RJ-45
Pin assign	Ethernet signal (MDI-X)
Cable	
Communication terminal	Cable connection
PC	straight
HUB	crossover
ROUTER	straight

(3) Connect the AC adapter to DC port to the WT adapter

-  • Never connect your personal computer to the ANT port of the WT adapter. Doing so may damage your personal computer.
-  • The cable connecting between the WT and WT adapter carries 24 VDC for the WT in addition to Ethernet signals. Before unplugging the cable connecting between the WT and WT adapter, make sure to unplug the DC jack of the WT adapter to turn the power off. Otherwise, the unit may be damaged.
- When closing the small window, make sure that the rubber packing of the small window is free from any foreign matter.
- The cable connecting the WT and WT adapter is a straight cable. Wrong connection may damage the unit.
- The Equipment for connection to WT adapter PC-interface(RJ-45) shall be appropriate to connect to TNV-1 circuits.
- For the connection WT adapter to WT and a cable suitable for outdoor use shall be installed.

7.10. Waterproofing WT small window

- (1) Pass the Ethernet cable through the cold-shrinkable tube (a) from the bonded portion of the spiral tube. Pay attention to the insertion direction (Figure 7-46).

Applicable LAN cable diameter: 5.0 mm to 5.7 mm

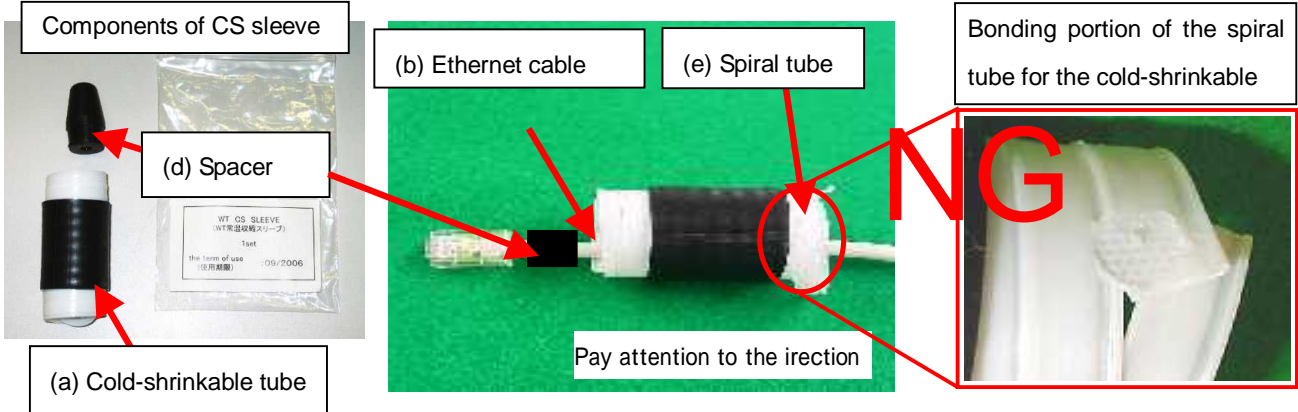


Figure 7-45

Figure 7-46

- (2) Connect the Ethernet cable to the WT (Figure 7-47).
- (3) Using cable ties (c) or the like, secure the Ethernet cable to the supporting bracket. Attach the cable ties 70 to 100 mm from the end of the supporting bracket. The cable is approximately 300 mm long measured from the cable joint (with a diameter of approximately 200 mm) to the first cable tie (Figure 7-48).



Figure 7-47

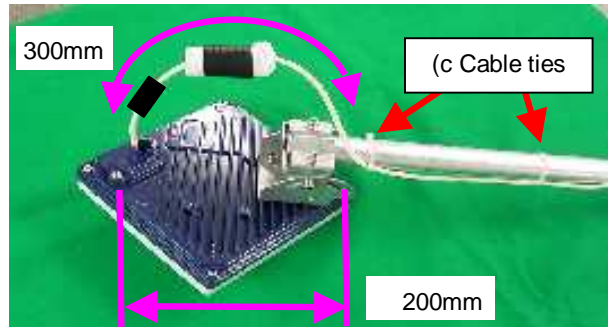


Figure 7-48



- Never allow the inside of the small window to become wet. Dampness may cause a malfunction. Connect the Ethernet cable perpendicular to the WT. Failure to do so will spoil the waterproofing effect, resulting in a device malfunction.

Cable perpendicular to the WT



Bent cable



(4) Mounting spacer (d)

- Mount the spacer on the Ethernet cable
- Make sure that the spacer is fully inserted in the small Lid of the WT (Figure 7-50).

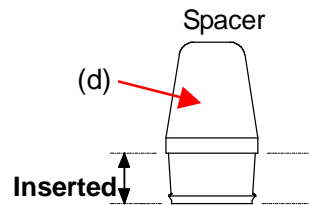


Figure 7-49



Figure 7-50

! • Insert the spacer into the small window fully. Partial insertion of the spacer will spoil the waterproofing effect.

(5) Mounting cold-shrinkable tube (a)

- Place the cold-shrinkable tube on the spacer and small Lid (Figure 7-51).
- Butt the end of the cold-shrinkable tube against the base of the small Lid. Pulling white spiral tube (e) to the very edge of the cold-shrinkable tube eases the subsequent procedure (Figure 7-51).
- Pull the spiral tube to mount the edge of the cold-shrinkable tube on the small Lid (Figure 7-52). Make sure that there is no gap between the cold-shrinkable tube and the base of the small Lid and between the spacer and the small Lid.
- Pull the spiral tube to mount the cold-shrinkable tube, paying attention so the spacer is not lifted (Figure 7-53 and Figure 7-54). Make sure that the spacer is not protruded from the cold-shrinkable tube. The top of the cold-shrinkable tube should be 5 mm or less from the top of the spacer.



Figure 7-51



Figure 7-52

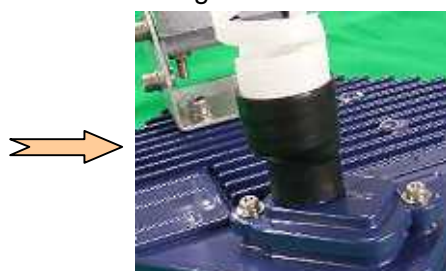


Figure 7-53

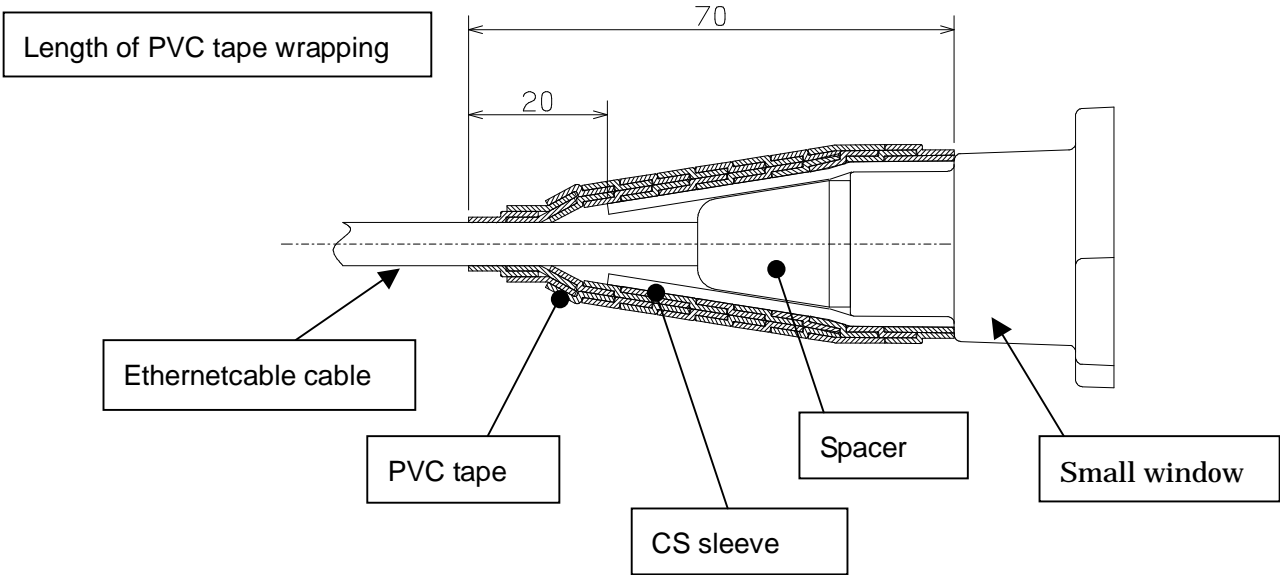
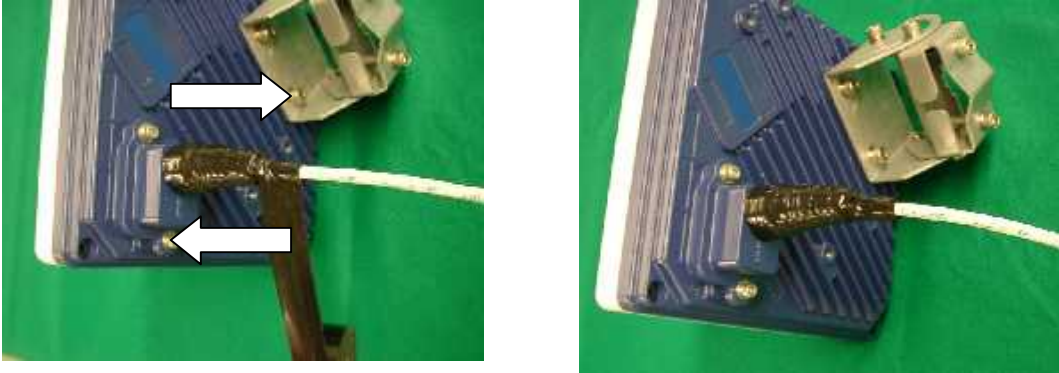


Figure 7-54

! • Slanted mounting of the cold-shrinkable tube as shown below will spoil the waterproofing effect. If the top of the cold-shrinkable tube is 5 mm or less from the top of the spacer, this will also spoil the waterproofing effect.

(6) Wrap the cable with PVC tape (for class 2 protection).

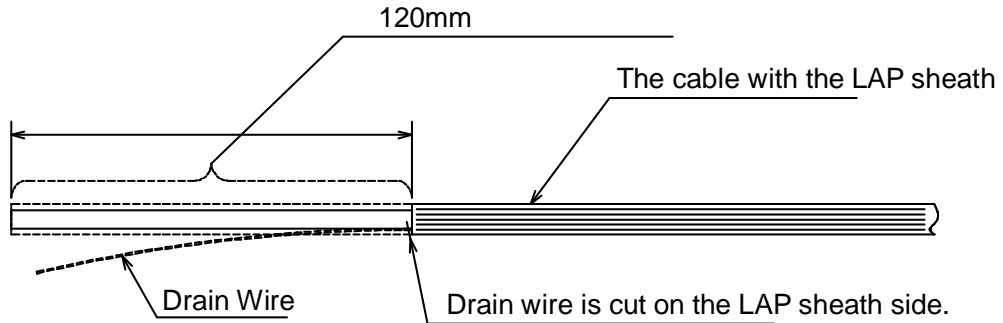
Apply the PVC tape so that the cold-shrinkable tube is completely hidden. Wrap the tape from the small Lid of the WT to the Ethernet cable, overlapping half of the previous layer. Next, reverse the wrapping direction and wrap one more time to the starting point.



7.11. When you use the cable with the LAP sheath for outdoor

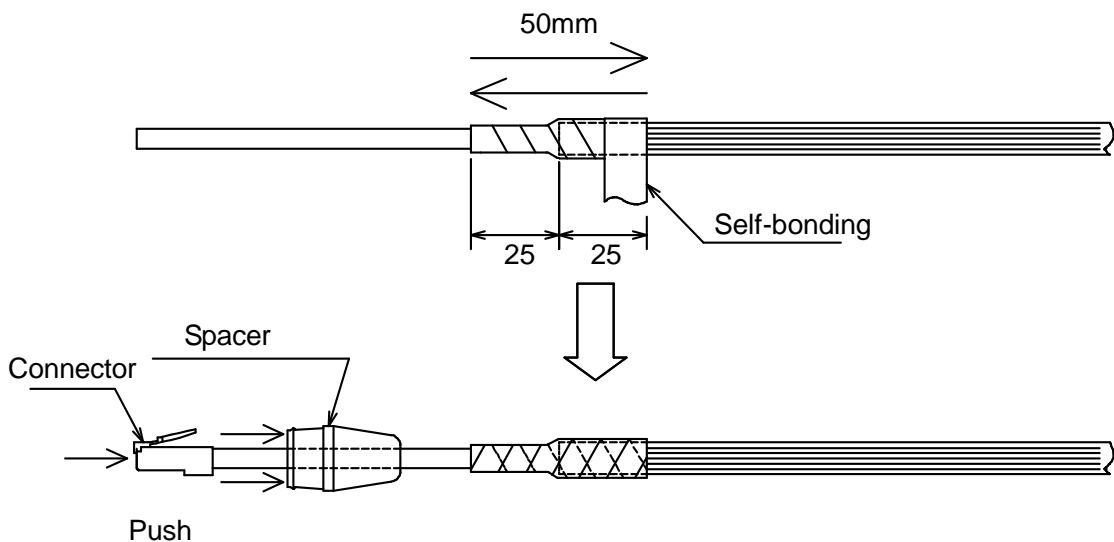
1 . Processing of LAP sheath

- The LPA sheath is peeled off from the cable point to 120mm.
- It cuts it in the part peeled off when there is drain wire.



2 . Processing of cutting part

- To prevent water being infiltrated in the wire, the self-bonding tape is rolled in the part where the LAP sheath was peeled off as shown in the figure below.
- The Ether plug is installed with the normal temperature shrinkage sleeve and Spasa passed.



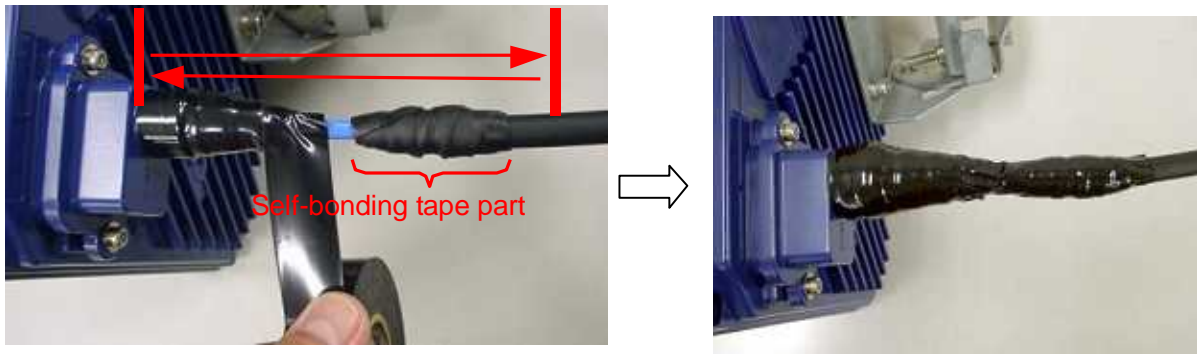
3 . Fixation of cable Ethernet, Installation of Spacer and normal temperature shrinkage sleeve

- See 「 6.9. Waterproofing WT small window 」

4 . Wrapping of PVC tape for protection

- It wraps until the self-bonding tape in the LAP sheath processing part is completely hidden

from a small window to the Ethernet cable side by 1/2 coming in succession, and 1 return round trip to the small window side.

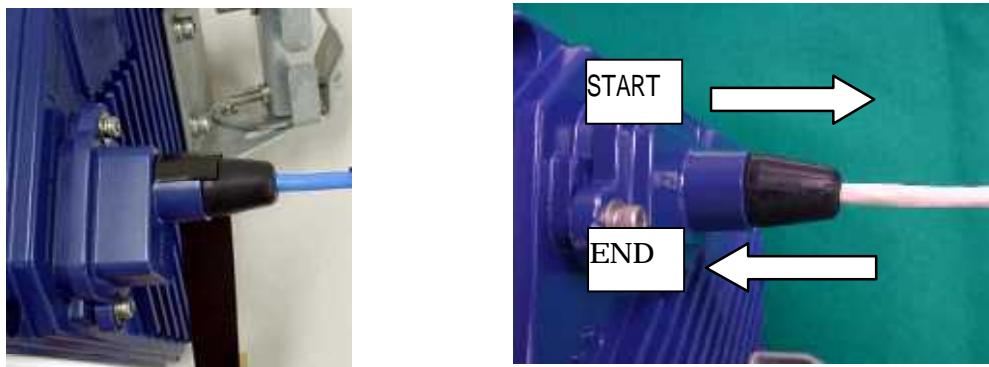


7.12. Waterproofing Without Using a Cold-Shrinkable Tube

If installing a cold-shrinkable tube fails, use off-the-shelf self-bonding tape to provide the waterproofing.

(1) Securing the small Lid of the WT and the spacer

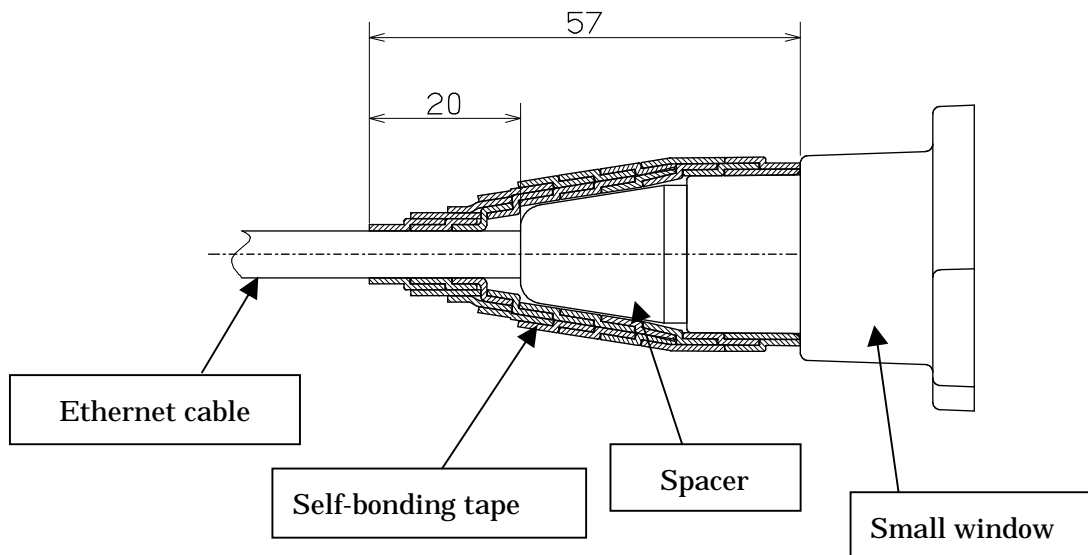
Using an appropriate length of self-bonding tape, wrap the tape around both the small Lid of the WT (at its base) and spacer one complete turn. After one turn, wrap about seven turns around the Ethernet cable by overlapping one-half of the previous turn. Reverse the wrapping direction and wrap about another seven turns back to the small Lid.





- For the stretching margin of self-bonding tape, see the instruction manual for the product.
- When wrapping self-bonding tape, start at the base of the small window and end at the end of the waterproof sleeve. Next, reverse the direction and end at the base of the small window. This procedure makes an attractive wrapping and improves the waterproof effect by making any air pockets less likely.
- Overlapping the wraps also protects against air pockets.
- Press evenly along the entire length of tape to remove air pockets.
- Make sure that there are no air pockets between the self-bonding tape and the small window of the WT or the rubber bushing. Air pockets will degrade the waterproofing effect.

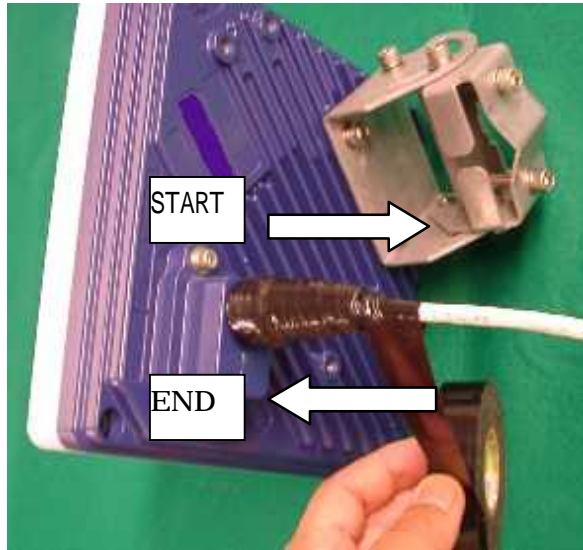
Overlapping half of the previous layer
(cross-sectional view)



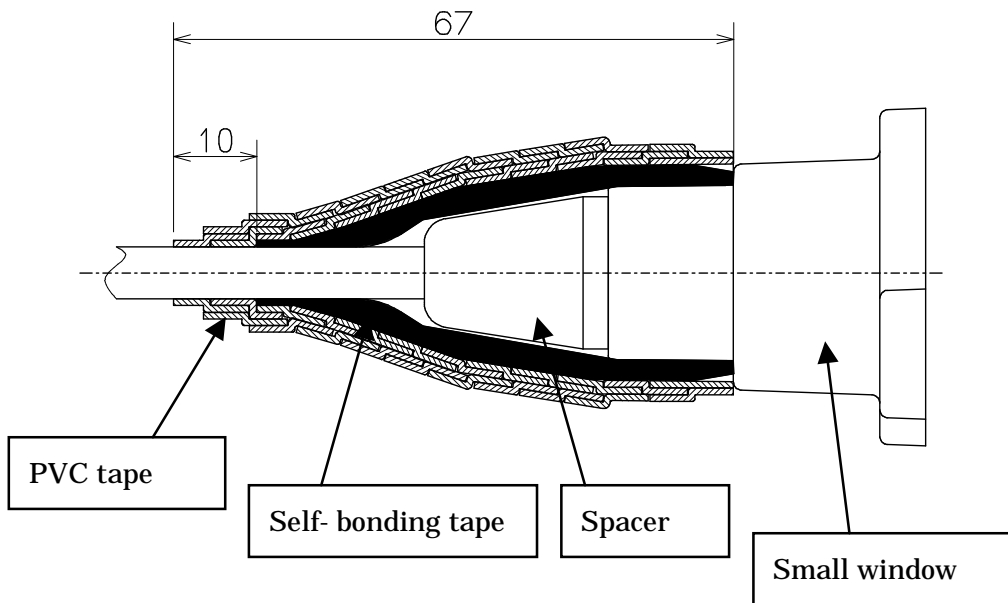
(2) Wrapping protective PVC tape

Apply the protective PVC tape so that the cold-shrinkable tube is completely hidden. Wrap the tape from the small Lid of the WT to the Ethernet cable, overlapping half of the previous layer. Next, reverse the wrapping direction and wrap one more time to the starting point. Using the PVC tape will guard the self-bonding tape against ultraviolet and other rays. The wrapping also helps increase strength.

Key point: When wrapping PVC tape, be sure that the self-bonding tape is completely covered for its protection.



Length of PVC tape used for wrapping



7.13. Testing

7.13.1. Ping test

Connect the WT and the PC as shown in Figure 7-55. Use the PC to perform a ping test in the following procedure.

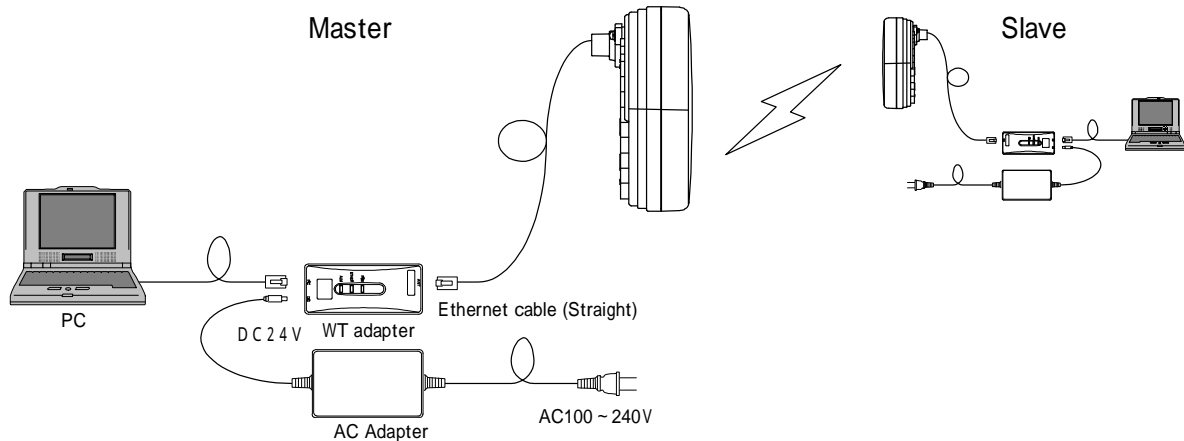


Figure 7-55 Ping Test System Diagram

Step 1: Start the Windows command prompt.

Step 2: Type the following command and press the Return key.

Ping xxx.xxx.xxx.xxx, where xxx.xxx.xxx.xxx shows the IP address of the opposite PC.

Step 3: After the command is run, check that a reply as shown in Figure 7-56 returns.

Figure 7-56 Ping Test

7.13.2. Measure the packet loss rate (with WT Local management tool)

Connect the WT Local Management Tool and measure the packet loss rate in the following procedure:

Step 1: Start the WT Local Management Tool and select P-P mode.

Step 2: Select the Radio Link Monitor tab.

Step 3: Set "Display Interval" to 1.

Step 4: Click the Start button to start traffic measurement.

Step 5: After traffic measurement for any length of time, click the Abort button to end traffic measurement.

Step 6: Check "Packet Loss Rate."

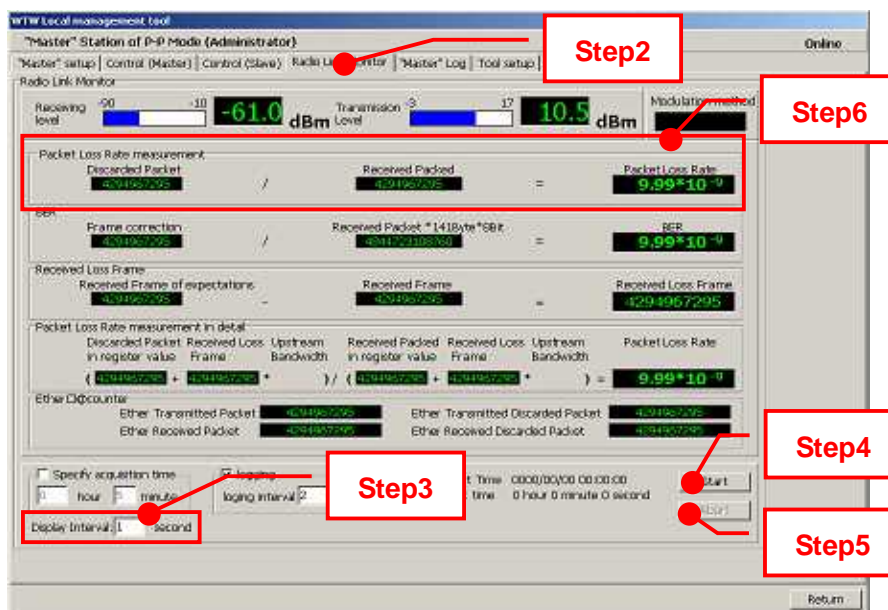


Figure 7-57 Measure the packet loss rate

7.13.3. Measure the packet loss rate (with OpS)

Connect the OpS terminal to the WT (Master) and measure the packet loss rate in the following procedure.

Step 1: Select the Traffic Information tab.

Step 2: Set "Display Interval" under "Traffic Acquisition."

Step 3: Select Save File as ON or OFF.

Step 4: Click the Execute button under "Traffic Acquisition" to start traffic measurement.

Step 5: After traffic measurement for any length of time, click the Abort button under "Traffic Acquisition" to end traffic measurement.

Step 6: Check "Packet Loss Rate."

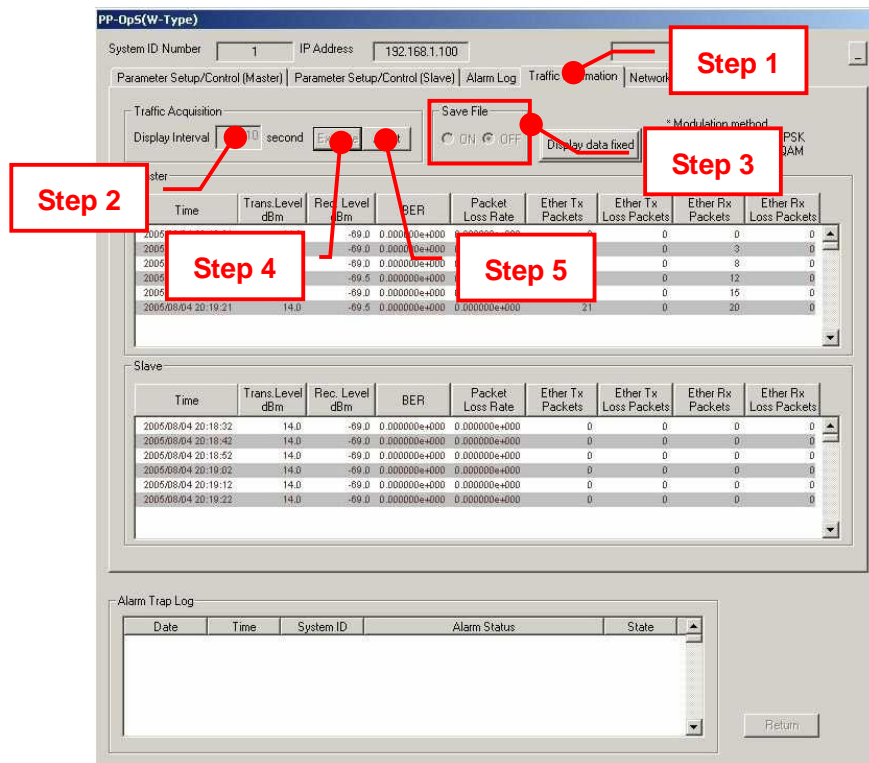


Figure 7-58 Measure the packet loss rate

7.14. Check sheet of Point to Point Construction

Check operation of the WT (Master/Slave) using the check sheet below.

Test procedure

(A) LED operation test

- Remove the AC adapter (to turn off the power) and make sure that all the LEDs go out.
- Insert the AC adapter (to turn on the power) and check the states of the LEDs.

(B) Loopback test between the WT and the WT adapter

- Press the TEST switch on the WT adapter and make sure that the ETHER LED goes out.
- Remove the cable from the WT adapter's PC port and make sure that the ETHER LED goes out.

(C) Receive level

- Connect the WT Local Management Tool to the WT and measure the receive level.

Table 7-1 Check sheet

WT	Serial number		Test date		
Test type	Test condition	Check item		Pass/fail	Measured value
LED operation test	Remove the AC adapter.	Confirm that the POW LED on the WT adapter goes out.			-
		Confirm that the ETHER LED on the WT adapter goes out.			-
		Confirm that the ALM LED on the WT adapter goes out.			-
	Insert the AC adapter.	Confirm that the POW LED on the WT adapter lights green.			
		Confirm that the ETHER LED on the WT adapter flashes green.			
		Confirm that the ALM LED on the WT adapter flashes at 1-second intervals and then goes out.			
Loopback test between WT and WT adapter		Confirm that the ETHER LED on the WT adapter goes out.			-
	Press the TEST switch on the WT adapter.	Confirm that the ETHER LED on the WT adapter goes out.			
Receive level	Remove the cable from the WT adapter's PC port.	Connect the WT Local Management Tool to the WT and measure the receive level.			dBm

8. Standard Tools to be Used

The table below lists the tools used during installation or maintenance of the units.

Table 8-1 Tools Used

No.	Unit name	Used for:		Tightening torque [N•cm]	Tool
1	AP-IFU	Door	M5	265	Torx driver (VESSEL T25H-120)
2		Power board	M4	127	Phillips screwdriver
3		Cable clamp	M4	118	Phillips screwdriver
4		Ground	M4 nut	127	Socket driver (Width across flats: 7)
5		SC lock(cap)	G3/8 nut	110 to 150	Spanner wrench (Width across flats: 22)
6	WT	Small window	M4	127	Torx driver (VESSEL T20H-120)
7		Mounting bracket	M6	850	Allen wrench (Width across flats: 5)
8		Ethernet cable			Crimping tool for RJ-45 (Release-after-crimp type)
9	AP-RFU (Omni)	Mounting bracket axis tightening	M6 M16	850 9410	Socket wrench (Width across flats: 24)
10	AP-RFU (Sectoral-Horn)	Mounting bracket	M6	850	Allen wrench (Width across flats: 5)

The appropriate tightening torque is $\pm 10\%$ of the value indicated in the table.

9. INITIAL VALUES

9.1. Point to Multipoint system

The factory-set initial values for a point-to-multipoint system are shown below.

9.1.1. Initial values for AP parameters (Point to Multipoint System)

Table 9-1 shows the AP initial values.

Table 9-1 Initial values for AP parameters

Parameters	Initial values	Setting range	Parameter which can be set up	
			Local management tool	PMP-OpS
Registered in AP-RFU memory				
AP transmission level	14	+14	<i>invalid</i>	valid
RFU transmission state	disable	disable/enbale	<i>invalid</i>	valid
Radio frequency	Not registered	Depends on the content of the registration of "ini FILE"	valid	<i>invalid</i>
Registered in AP-IFU memory				
AP ID number	0	0 ~ 65535	<i>invalid</i>	valid
AP registration status	Not registered	Registered/Not registerd	<i>invalid</i>	valid
Upstream arbitration bandwidth	2	1 ~ 8 (Total bandwidth corresponds to 10)	<i>invalid</i>	valid
OpS frame VLAN priority	4	0 ~ 7	valid	<i>invalid</i>
User frame VLAN priority	0	0 ~ 7	valid	<i>invalid</i>
OpS frame VLAN-ID	0	2 ~ 4094	valid	<i>invalid</i>
Modulation method	Mixed	QPSK/16QAM/Mixed	<i>invalid</i>	valid
IP addrss	192.168.0.1	0.0.0.0 ~ 255.255.255.255	valid	<i>invalid</i>
Subnet mask	255.255.255.0	0.0.0.0 ~ 255.255.255.255	valid	<i>invalid</i>
Default gateway	192.168.0.254	0.0.0.0 ~ 255.255.255.255	valid	<i>invalid</i>
Trap destination 1 status	Registered	Registered /Not registered	valid	valid
Trap destination IP address 1	192.168.0.2	0.0.0.0 ~ 255.255.255.255	valid	valid
Trap destination 2 status	Not registered	Registered /Not registered	valid	valid
Trap destination IP address 2	192.168.0.3	0.0.0.0 ~ 255.255.255.255	valid	valid
Trap destination 3 status	Not registered	Registered /Not registered	valid	valid
Trap destination IP address 3	192.168.0.4	0.0.0.0 ~ 255.255.255.255	valid	valid

Trap destination 4 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 4	192.168.0.5	0.0.0.0 ~ 255.255.255.255	<i>invalid</i>	valid
Trap destination 5 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 5	192.168.0.6	0.0.0.0 ~ 255.255.255.255	<i>invalid</i>	valid
Trap destination 6 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 6	192.168.0.7	0.0.0.0 ~ 255.255.255.255	<i>invalid</i>	valid
Trap destination 7 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 7	192.168.0.8	0.0.0.0 ~ 255.255.255.255	<i>invalid</i>	valid
Trap destination 8 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 8	192.168.0.9	0.0.0.0 ~ 255.255.255.255	<i>invalid</i>	valid
Trap destination 9 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 9	192.168.0.10	0.0.0.0 ~ 255.255.255.255	<i>invalid</i>	valid
Trap destination 10 status	Not registered	Registered /Not registered	<i>invalid</i>	valid
Trap destination IP address 10	192.168.0.11	0.0.0.0 ~ 255.255.255.255	valid	<i>invalid</i>
Ether-IF 1	Active	Active/Non-active	valid	<i>invalid</i>
Ether-IF 2	Non-active	Active/Non-active	valid	<i>invalid</i>

9.1.2. Initial values for WT(1 - 239) parameters (Point to Multipoint system)

Table 9-2 Initial values for WT(1 - 239) parameters (Point to Multipoint system)

Parameters	Initial values	Setting range	Parameter which can be set up	
			Local management tool	PP-OpS
Registered in AP-IFU memory				
WT serial number	All space	ASCII: 7 characters	invalid (Only display)	valid
Authentication parameter	All space	ASCII: 10 characters	invalid (Only display)	valid
VLAN-tag control	Non transparent	Non transparent /transparent	invalid (Only display)	valid
Interface class	AUTO	AUTO/10BASE	invalid (Only display)	valid

9.1.3. Initial values for VID(2 - 4094) table parameters (Point to Multipoint system)

Table 9-3 Initial values for VID(2 - 4094) table parameters (Point to Multipoint system)

Parameters	Initial values	Setting range	Parameter which can be set up	
			Local management tool	PP-OpS
Registered in AP-IFU memory				
WT ID number	0	0 ~ 239	invalid (Only display)	valid
Service status	Out of service	Out of service /In service	invalid (Only display)	valid

9.1.4. Initial values for AP-IFU swiches

Table 9-4 Initial values for AP-IFU swiches

Iteme	Initial values
ETHER1 AUTO/100FULL SW	100FULL
ETHER2 AUTO/100FULL SW	100FULL

9.1.5. Initial values for WT(Master) parameters (Point to point System)

Table 9-5 lists the WT defaults set in the factory.

	Parameters	Initial values	Setting range	Parameter which can be set up	
				WT Local management tool	PP-OpS
1	Registered information	Not registered	Registration/Not registration	valid	valid
2	System ID number	0	1-65535	valid	valid
3	Opposite-station serial number	11 blank characters	7 single-byte alphanumeric characters	valid	<i>invalid</i>
4	Encryption parameter	10 blank characters	5 single-byte alphanumeric characters	valid	<i>invalid</i>
5	Send level	14dBm	-6 - +14dBm	valid	valid
6	Modulation method	16QAM	16QAM/QPSK/AUTO(reserved)	valid	valid
7	Interface	AUTO	AUTO/10BASE	valid	<i>invalid</i>
8	Radio frequency	Not set	Based on the registered ini file	valid	<i>invalid</i>
9	Master ATPC	OFF	OFF/ON	valid	valid
10	IP ADDRESS	192.168.1.100	0.0.0.0 - 255.255.255.255	valid	<i>invalid</i>
11	Subnet mask	255.255.255.0	0.0.0.0 - 255.255.255.255	valid	<i>invalid</i>
12	Default gateway	192.168.1.254	0.0.0.0 - 255.255.255.255	valid	<i>invalid</i>
13	Trap destination 1 to 10	0.0.0.0	0.0.0.0 - 255.255.255.255	valid (only 1 - 3)	valid
14	VLAN tag	OFF	OFF/ON	valid	<i>invalid</i>
15	OpS VID	0	1 -4094	valid	<i>invalid</i>
16	OpS priority	0	0 - 7	valid	<i>invalid</i>
17	ARP response	ON	ON/OFF	valid	<i>invalid</i>
18	Disable transmission	OFF	ON/OFF	valid	valid
19	Slave ATPC	OFF	OFF/ON	valid	valid
20	Read community name	public	10 single-byte characters	valid	<i>invalid</i>
21	Write community name	public	10 single-byte characters	valid	<i>invalid</i>
22	Trap community name	public	10 single-byte characters	valid	<i>invalid</i>

9.1.6. Initial values for WT (Slave) parameters (Point to point System)

Table 9-6 lists the WT defaults set in the factory.

	Parameters	Initial values	Setting range	Setting tool	
				WT Local management tool	PP-OpS
1	System ID number	0	1-65535	valid	<i>invalid</i>
2	serial number at Opposite WT	11 blank characters	7 single-byte alphanumeric characters	valid	<i>invalid</i>
3	Encryption parameter	10 blank characters	5 single-byte alphanumeric characters	valid	<i>invalid</i>
4	Transmit level	14dBm	-6 - +14dBm	valid	<i>invalid</i>
5	Interface class	AUTO	AUTO/100BASE	valid	<i>invalid</i>
6	Radio frequency	Not set	Based on the registered ini file	valid	<i>invalid</i>
7	IP ADDRESS	192.168.1.100	0.0.0.0 - 255.255.255.255	valid	<i>invalid</i>
8	Subnet mask	255.255.255.0	0.0.0.0 - 255.255.255.255	valid	<i>invalid</i>
9	Default gateway	192.168.1.254	0.0.0.0 - 255.255.255.255	valid	<i>invalid</i>
10	ARP response	ON	ON/OFF	valid	<i>invalid</i>

10. System example Point to Multipoint system

An example point-to-multipoint system configuration is shown in Figure 10-1.

The settings of this system configuration are as follows:

AP setting: Table 10-1

WT setting: Table 10-2

VLAN switch setting: Figure 10-2

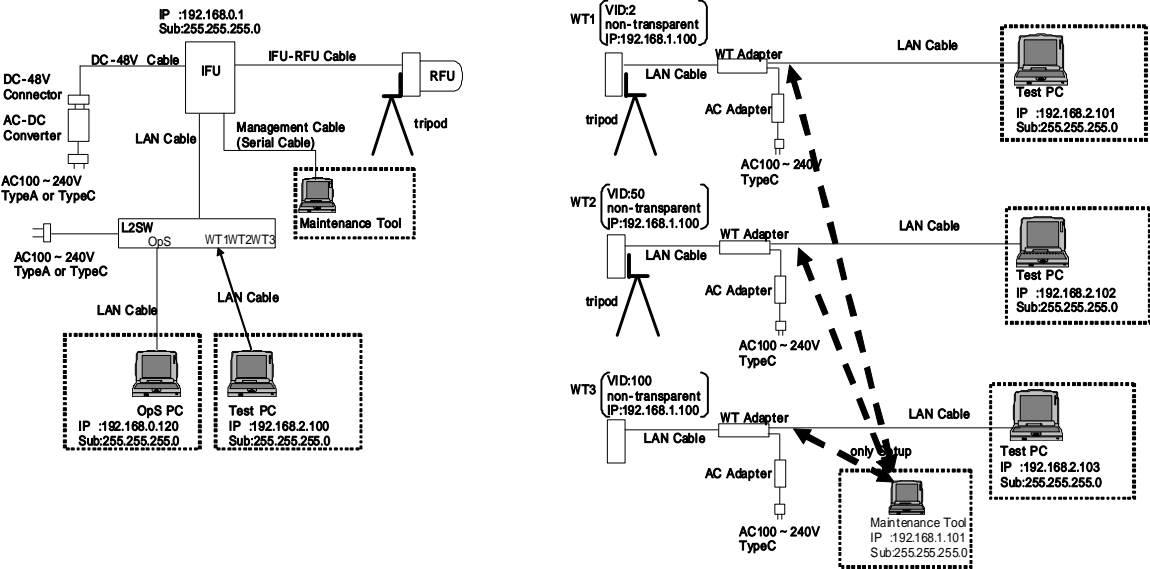


Figure 10-1 System example Point to Multipoint

Table 10-1 Setup parameters AP(Point to Multipoint)

AP		
Item	Value	Tool
OpS Frame Priority	4	Management Tool
User Frame Priority	0	Management Tool
OpS Frame Vlan-ID	500	Management Tool
AP IP address	192.168.0.1	Management Tool
Subnet mask	255.255.255.0	Management Tool
Default gateway	192.168.0.254	Management Tool
Trap Des. IP1	192.168.0.120	Management Tool
Trap Des. IP2	non-Reg	Management Tool
Trap Des. IP3	non-Reg	Management Tool
Ether-IF1	Active	Management Tool
Ether-IF2	non-Active	Management Tool
Radio frequency		Management Tool
AP ID number	1	OpS
Upstream Arbi.BW	2	OpS
AP Trans. Level	14	OpS
AP Reg. Status	Reg	OpS
RFU Transmission	Enable	OpS
Modulation Method	Mixed	OpS

Table 10-2 Setup parameters WT(Point to Multipoint)

WT	WT1	WT2	WT3	
Item	Value	Value	Value	Tool
WT ID Number	1	2	3	Management Tool
AP ID Number	1	1	1	Management Tool
Encryption Parameter	1234567890	0987654321	9876543210	Management Tool
Select WT ID number	1	2	3	OpS
VLAN-TAG Cont	non-transparent	non-transparent	non-transparent	OpS
Authen. Param	1234567890	0987654321	9876543210	OpS
Serial number (example)	NJJW000011T	NJJW000012T	NJJW000013T	OpS
WT Reg. Status	Reg	Reg	Reg	OpS
Modulation Method	adaptive	adaptive	adaptive	OpS
Interface Class	Auto	Auto	Auto	OpS
RFU Transmission	Enable	Enable	Enable	OpS
VLAN-ID	2	50	100	OpS
VLAN-ID Registration Status	Reg	Reg	Reg	OpS
Out of Service / In Service	In Service	In Service	In Service	OpS

Point to Multipoint VLAN SW parameters

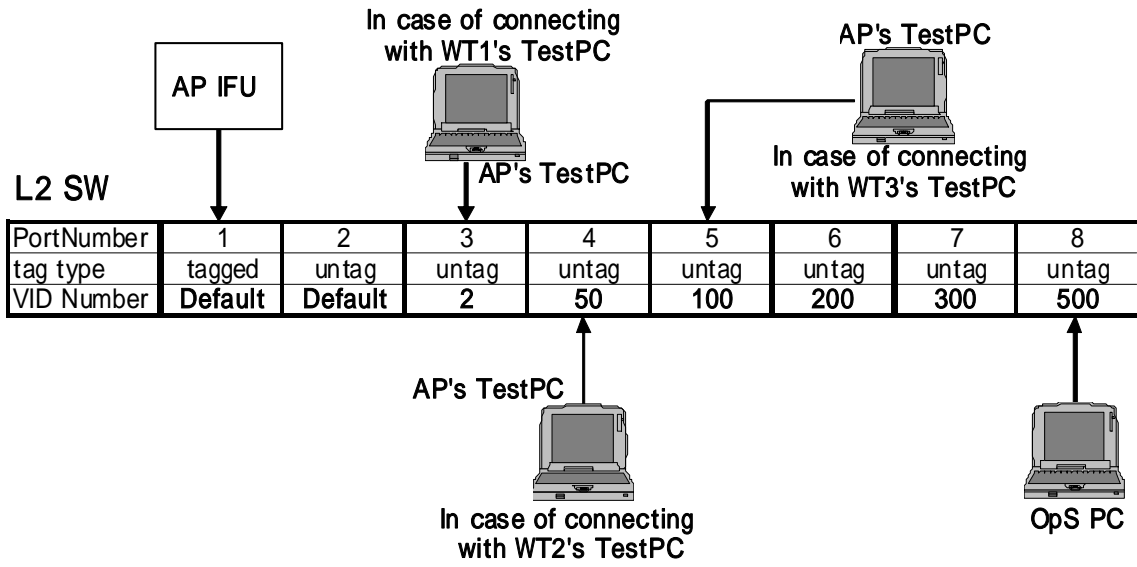


Figure 10-2 Point to Multipoint VLAN SW parameters

11. System example Point to Point

An example point-to-point system configuration is shown in Figure 11-1.

The settings of this system configuration are as follows:

setting: Table 11-1

VLAN switch setting: Figure 11-2

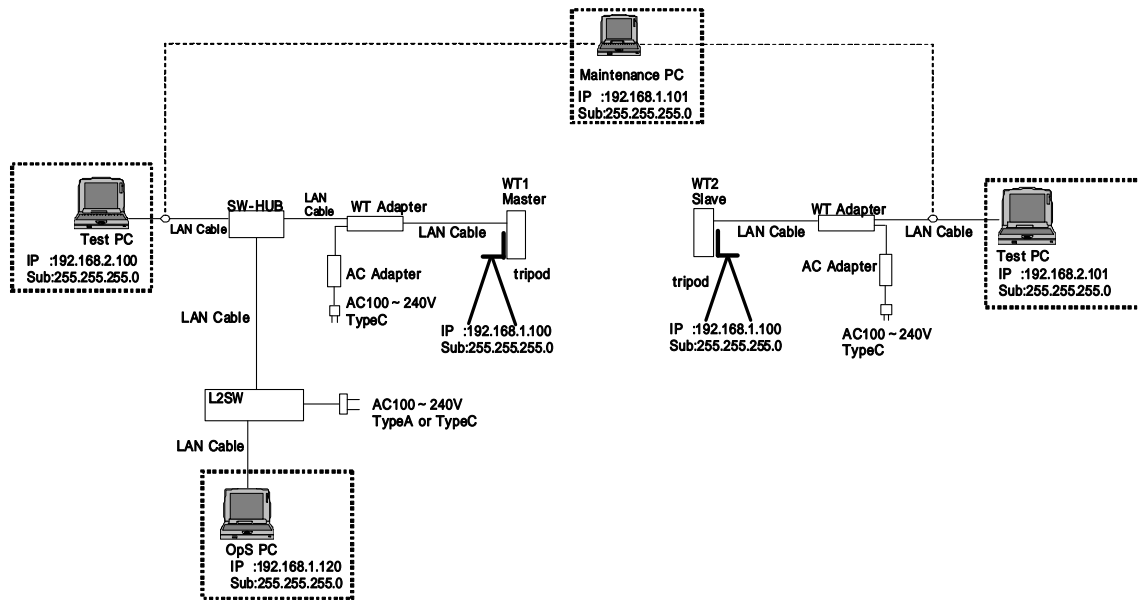


Figure 11-1 System example Point to Point

Table 11-1 Setup parameters WT(Master) / WT(Slave) (Point to Point)

	WT1 (Master)	WT2 (Slave)	
Item	Value	Value	Tool
System ID number	11111	11111	Management Tool
Encryption Parameter	12345	12345	Management Tool
Sireal No.			Management Tool
Trans. level	14	14	Management Tool
OpS Fra. Praiority	0	-	Management Tool
OpS Fra. Vlan-ID	500	-	Management Tool
IP address	192.168.1.100	-	Management Tool
Subnet mask	255.255.255.0	-	Management Tool
Default gateway	192.168.1.254	-	Management Tool
Trap Des. IP Add.1	192.168.1.120	-	Management Tool
Trap Des. IP Add.2	non-Reg	-	Management Tool
Trap Des. IP Add.3	non-Reg	-	Management Tool
Interface Class	AUTO	-	Management Tool
Reg. Status	Registered	-	Management Tool
RFU Transimission	Enable	-	Management Tool /OpS
Radio frequency			Management Tool
ATPC	off	off	Management Tool

Point to Point VLAN SW parameters

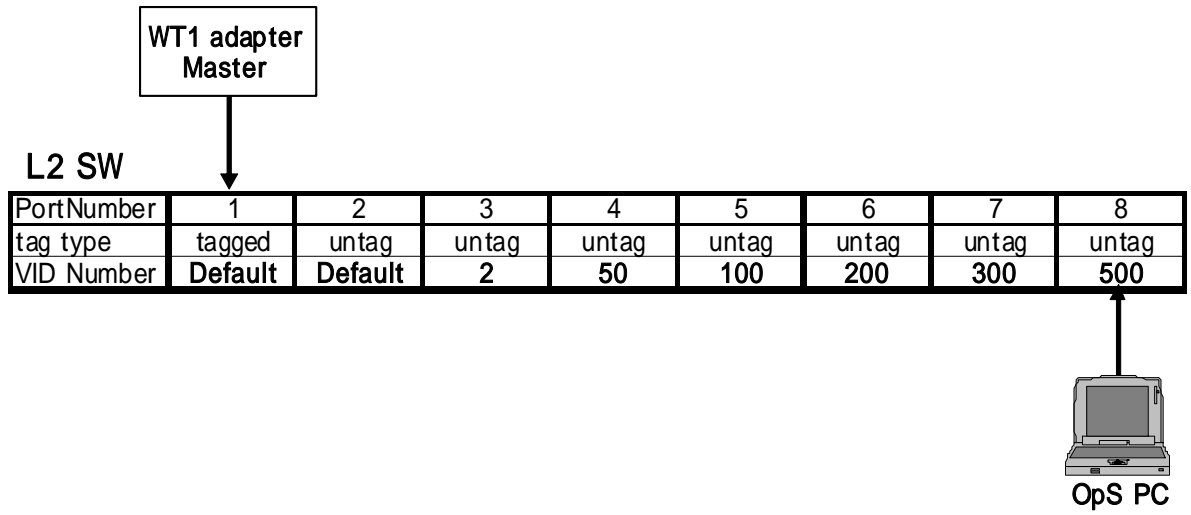


Figure 11-2 Point to Point VLAN SW parameters

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