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.
- Step2Secure the WT mounting bracket to the pole using the bolts.Applicable pole diameter: From Φ31.8mm to Φ34mm



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. TOP V Vertical polarization ТОР 0 Ó (\oplus) C Ð H d O Figure 6-8 Vertical Polarization Horizontal polarization TOP H 6 (\oplus) Ð TOP H \subset TYPE-STOLD 20 TOP V \mathbf{O} $\square(0)$ \mathbf{O}

Figure 6-9 Horizontal Polarization

0

(0)

6.6. Installing the WT (External Antenna)

6.6.1.Installing the WT (External 30cm Antenna)

1. <u>**Ф30cm** antenna installation procedure</u>

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

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





Figure 6-10 Φ30cm antenna

Figure 6-11

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 : <u>57 N· cm</u>



Figure 6-12



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)







Figure 6-14

V polarization

Figure 6-15

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 : <u>265 N·cm</u>





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



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. <u>Φ60cm antenna installation procedure</u>

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

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

O-ring







Figure 6-20 Ф30cm 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 : <u>57 N· cm</u>



Figure 6-22



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)









V polarization

Figure 6-25

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 : <u>265 N·cm</u>





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) Plate



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.

ecetting .90 vel	⁴⁰ -99.0 d	Transmission -3 Bm Leve	17 14.0	dBm	ulation Method
Packet Loss Rate meas Discarded Pac	urement Iket	Received Packs	ed	Packet Loss	Rate
QP5K 425456725	5 /	4294967295	=	9,99*	10 ⁻⁹
16QAM	5 /	4204957205	.	9,99*	10-9
ER Frame course	ton	Pereived Parket *14	1Euto*00.#	pco	
QPSK CHELEAVE	5	EGHINGONG		9,99*	10-2
16QAM 429496729	5 1	484472310875		9.99*	1019
eceived Loss Frame Received Fram	e of expectations	Received Fram	e =	Received Los	s Frame
acket Loss Rate measu Discanded Pack in register valu QPSK (rement in detail et Received Loss Arbitra e Frame Bandy + 525555555 12	stream Received Packed atton in register value)/ (00040000000 01	Received Loss Downstrea Frame Bandwidth	^m Packet Loss	Rate
16QAM(122196729	+)/ (4254957252 0	* 10)	= 9.99*	10 ⁻⁹
F Specify acquisition	n time 🛛 🖓 logging ninute Loging interva	second	Start Time 2002/01/01 10:00:0	o _	Start

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 when the antenna type is the vertical polarization

Figure 6-33 How to Install Direction Adjustment tool

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: 8.5N•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.





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]		
TX Sectoral Antenna Gain:15.5dBi _{TYP}	46.5	[dBi]
RX WT Antenna Gain:31dBi _{TYP}		

Free space loss Lp[dB]

$$\begin{bmatrix} m \end{bmatrix} = \frac{c \begin{bmatrix} m \end{bmatrix}}{f \begin{bmatrix} Hz \end{bmatrix}}$$

$$Lp = 20 \log \begin{bmatrix} 4 & d \\ \hline & \end{bmatrix}$$





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

Free space loss Lp[dB]

$$\begin{bmatrix} m \end{bmatrix} = \frac{c \begin{bmatrix} m \end{bmatrix}}{f \begin{bmatrix} Hz \end{bmatrix}}$$

$$Lp = 20 \log \begin{bmatrix} 4 & d \\ \hline & \end{bmatrix}$$



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

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

Free space loss Lp[dB]

$$\begin{bmatrix} m \end{bmatrix} = \frac{c \begin{bmatrix} m \end{bmatrix}}{f \begin{bmatrix} Hz \end{bmatrix}}$$

$$Lp = 20 \log \begin{bmatrix} 4 & d \\ \hline & \end{bmatrix}$$



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

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

Free space loss Lp[dB]
$\begin{bmatrix} m \end{bmatrix} = \frac{c \begin{bmatrix} m \end{bmatrix}}{f \begin{bmatrix} Hz \end{bmatrix}}$
$Lp = 20 \log \left[\frac{4 d}{2}\right]$

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.
 6-99

6.10. Waterproofing WT small window

 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 6-52

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.



Push

- 3 . Fixation of cable Ethernet, Installation of Spacer and normal temperature shrinkage sleeve
 - See ^r 6.9. Waterproofing WT small window _J
- 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 pocketsless 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

Transmittion time

: The result will vary depending on the distance.

Step 2	AP ID Number: 1 IP Address: 10.60.68.153 Step 1
	Accept OK Result Timeout Received frame length 0 Transmission time 1000 ms
	AP Alarm Trap Log Date Time AP ID Alarm Status State Return

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.

tep 2	IP A	Idress:	192.168.01 Terme Alar	Step 1	ating Status I	Step 4	vn Loading B	andWidth Table	
Select WT ID Number ID State 001 Not 002 Reg. 003 Not 004 Not 005 Not 006 Not 007 Not 008 Not	(with Loop Packet Loo With Loop Packet Loo With Moni Received Packet	measure back 500 measure back 10 mse se Rate measure tor) s [5201	rement arement 2) arement Transm	Tecket L Display J Modulatii RetryTin Result	oss Rate mea nterval on Method (on le	asurement (with Lu ly Adaptive)	oop back, 10 m secc 6QAM	Insec) Save Fill Ind C ON C OF minutes Execute A Display data	e F
Time	Trans.Level	Rec. Level	BER	Packet	Ether Tx	Ether Tx	Ether Rx	Ether Rx	
2005/09/24 15:33:59 2005/09/24 15:34:03	14.0 14.0	-61.5 -61.5	0.000000e-000 0.000000e-000	0.000000e-000 0.000000e-000	3069 3473	Des rackets D	3069 3473	D D	
2005/09/24 15:34:07 2005/09/24 15:34:10	14.0 14.0	-61.5 -61.5	0.000000e-000 0.000000e-000	0.000000e-000 0.000000e-000	3877 4281	0	3877 4281	0 0	
2005/09/24 15:34:14 2005/09/24 15:34:19	14.0 14.0	-61.5 -61.5	0.000000e-000 0.000000e-000	0.000000e-000 0.000000e-000	4685 5089	0 0	4685 5089	0 0	-
- 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	-63.5	2.663125e-DD6	0.000000e-004	0	D	0	0	
2005/09/24 15:34:03	14.0	-63.0	2.510143e-006	0.000000e-004	D	0	0	0	
2005/09/24 15:34:07	14.0	-63.0	2.023270e-000	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	ů	0	
2005/09/24 15:34:19	14.0	-63.0	2.854808e-006	0.000000e-004	D	0	D	D	
' Alarm Trap Log								_	
Date Time	AP ID		Alarm Status	Î.	State		Step 5		
Date Time	J AP ID		Alarm Status		State			Return	

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

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

Table 6-1 Check sheet

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.





- 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.

	"Master" Station of P-P Mode (advantistrat "Master" Fetue (Grant Date) (Antici (Save: Step2 or "Log Tool setue)	Online
Step1	Setup reventioners Network configuration Perg Status P Address Setup reventioners Softer mail Trace. Level Id geny Modulation Network Id geny Network Configuration Interface law Thirthoge law Auto State Interface law	Nam Disement millerction HartsnanceLink Down Modern Sync. Dror Authoritics Coperation IRSI Tracomicon encoder
	Setup Farameters 2 Good Setting (2005/00/02 19/31:14 Setup: Setup Reameters 3 BRU Transmission dicate Escuprent Enformation Martine (258957 B000000 Ethemet Interface Status (2008) Ethemet Interface Status (2008) (2008)	<u>стор Арсан</u> Step4 <u>имс Асібно</u> я 500000 о 2000001/16 Step6

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.

step1	Setup Parameters		4am
<u> </u>	Sofue System 10 Number st oppose WT Bronyscon Parameter Tram, Level Hertoce Oss Rado finauency 25:207 : E08L2 ± GHz	Network configuration IP Address Ive 1ex.1 . 100 Submet mask 205.205.205.0 Default gatherer app request Ive 108.1 .204 	Datament milliocitien Martionance Life Down Mocken Sync. Drux Auffert REU Transit REU Transit REU Transit and Ac
	Equement Internation Nodel Name Hot Same (INSOTVERWINDLA Stramet Interface Status (SDOERSE)	Step2	ANG BOOM TO DE 22:37



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.
- Step2Secure the WT mounting bracket to the pole using the bolts.Applicable pole diameter: From Φ31.8mm to Φ34mm



gure 7-4 Installing the WT

Fi

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.





7.5.2. Example of Installing the WT

(1) On a metal fence





Figure 7-6 Installing on a metal fence





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 $\boxed{\text{TOP V}}$ at the top. For horizontal polarization, position $\boxed{\text{TOP H}}$ at the top.



Figure 7-9 Horizontal Polarization

7.6. Installing the WT (External Antenna)

7.6.1.Installing the WT (External 30cm Antenna)

1. <u>Φ30cm antenna installation procedure</u>

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)





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)







Figure 7-14

V polarization

Figure 7-15

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 : <u>265 N·cm</u>





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. <u>**Ф60cm antenna installation procedure</u>**</u>

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

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

O-ring







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 : <u>57 N· cm</u>



Figure 7-22



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)









V polarization

Figure 7-25

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 : <u>265 N·cm</u>





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) Plate



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.

V

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

ao Link	Monitor	10				(Îs	had up to a mathematic	
Receivir level	ng -90	-61.0		an 'd	10.5	dBm	loodadon mee loo	
Packet	t Loss Rate measuren	nent						
	Discarded Packet	1	Rec	eived Packed	=	Packet 9.9	t Loss Rate 99*10 ⁻⁹	
ER								
	Frame correction	1	Received	Packet * 1418yte* 88	e =	9.9	BER 99*10-9	
Receive	ed Loss Frame		3	1744		2.12		
	Received Frame of	expectations -	Rec	eived Frame	.=:	Receive	d Loss Frame 1967295	
Packet	Loss Rate measurem Discarded Packet in register value (120/06/225 +	ent in detai Received Loss Up Frame Bar	stream Receiv ndwidth in regi)/ (ed Packed Received ster value Frame 967295 + 4294967	Loss Upstream Bandwidth	Packet	t Loss Rate	
Ether C	Counter Ether Trans Ether Receiv	mitted Packet 199 ved Packet	12980/7295 1294967295	Ether Transmitte Ether Received (ed Discarded Pack Discarded Packet	et 199 420	4967295 4967295	
Spe	ofy acquisition time- hour 🙃 minute	l⊽ logging loging interv	al 2 second	Start Time past time	: 0000/00/00 0 0 hour 0 minu):00:00 te 0 second	Start	
Vendous Te	Interval: 1 secon	d					Conner 1	

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.

and such as I constant default (Barle	I an Manter I man	or such water the second	ar.				: Orange
dio Link Monitor	Carl operation 1 200	e rod t roo rere	b F				
Facal-mp 90 -10	61.0	Turnento -	1			ApdLéation method	
level	dBr	n Lovor			dBm		
Packet Loss Rate measurement							
Discarded Facket		Received	Packed	-	Packe	tLom Rate	
ALCONG / LOG	<u>(</u>	//====				99-10	
008 Grame convertion		Paramet Party	171410-01700-0			100	
424466226	χ.	Contract Process	List.	14	9.	99*10-1	
Received Loss Frame							
Received Ivane of expe	clations	Received	Prame		flactorie	d Losi Frame	
	*	100,000	102	- 14	429	4967295	
Packet Loss Rate measurement in	detal	and the second second second	and Brook and a	. Barrenter	and Bankin	Law Bette	
in register value	ne Bandwid	tern register v	ive Franc	Bandwidt	ini Pacia	LOUI Nate	
(200000000 + 2000	-)/ (-			99*10-9	
Ether Discounter	1930	10.1224			100		
Ethiy Transmitter	Packet		the Transitied	Chicarded Pad	ant the	1167295	
Ether Perceved P	cost methods		CIEF NOCEWOO LIS	Carding Machine			
E Sperify acquisition time	Ringer				an a	I	
boxmade	Inner eterat	- second	start time part time	Obelaciona o menu	te C second	Start	
and a second sec	of a constant					- Root	
Dopley Interval; 1 second							

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.

aster" setup Control (Master) Control (Si	we) Radio Link Monitor "Master" Log. Tool setup	
stup Parameters		Alarm
Satup	Network configuration	
Reg. Status	IP Address 192 160,1 .100	Equipment mailunctio
Bystem ID Number	Subret mask 255, 255, 255, 0	Maintenance Link Dow
Senial Number al.	Default gateway 192 168,1 254	
poposte WT Incryption Parameter	Trap Des. IP Add 1 Nov w	Modern Sync. Brot
Turni Level	Trap Dec. IP Add 2 Not al	Authoritication Enking
tockilation Method	Trap Des. IP Add 3 [has a	
interface Cass	CoS Rame VLW-Tap Im affecting w	
tatio frauency	max Control of the second s	Cparation
ATPC OFF T	ADD nerseert	100AT TRACTICE Protection
	20.0000 000 <u>10</u>	Log Acquestion OFF
	540.	200
dup Paramoters 2	Setup Parameters 3	
Clock Setting \$2075/09/02 19:31-1-	Sefup RFU Transmission	duble 👻 Execute
append Information		1
Model Mane	Hadware Verson Software Verson Seria	Auniter MAC Address
Mester 294967	0123456	00:00.27:03:00.01
Sper	d Dupler	and the second se
Ethernet Interface Status 100BA	E Jul Ducker Modulation Method (350)494	Oock (2000,01,01 02:26:14

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.

tup Paramitian				Alam
Serice Sirclern IZ Mamber Serich Number 24 opposite WY Bromption Paramete Interface Cass Hadio Requency	11111 0122456 4 12345 14 1890 14 1890 19 25 207 (608.2 • 9	Beitwerk configuration IP Address [10] Subset mask Default genevan ARP request [24] 4	1691 100 1552 2550 1691 254	Equipment mailunction Maintenance LPA Doan Modern Sync, Einor Authentscation Pailure RPU Transmission
upment Information	Model Name	Hardware Version Software Version	ion Sorial Number Rev199993	MAE Addross 00.00327:03.00101

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

7.7.1.2. Roughly Adjusting the Direction

- Step1 As shown inFigure 7-35 and Figure7-36, 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

Figure7-36 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.



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]		
TX WT Antenna Gain:31dBiTYP	62	[dBi]
RX WT Antenna Gain:31dBi _{TYP}		

Free space loss Lp[dB]

$$\begin{bmatrix} m \end{bmatrix} = \frac{c \begin{bmatrix} m \end{bmatrix}}{f \begin{bmatrix} Hz \end{bmatrix}}$$

$$Lp = 20 \log \begin{bmatrix} 4 & d \\ \hline \end{bmatrix}$$



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

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

Free space loss Lp[dB] $\begin{bmatrix} m \end{bmatrix} = \frac{c \begin{bmatrix} m \end{bmatrix}}{f \begin{bmatrix} Hz \end{bmatrix}}$ $Lp = 20 \log \begin{bmatrix} 4 & d \end{bmatrix}$

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

 $|\odot$

 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

 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).









 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).



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 7-54

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.



- Fixation of cable Ethernet, Installation of Spacer and normal temperature shrinkage sleeve
 See ^r 6.9. Waterproofing WT small window J
- 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 pocketsless 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.




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, where 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 mnagement 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."

teceving 90 -	¹⁰ -61.0 dBi	Transmission 3	10.5	dBm Maculato	Step6
Packet Loss Rate measureme					
Discarded Packet	1	Received Pracket	. =	9.99*10	
10. The second se		Theory of Design and State			
A STORE CONSCION	1	49117740375	=	9.99*10	
leceived Loss Frame		Transmit Province		Burning and Para	
Received Frame of e	-	Received Hrame		120204057295	
Packet Loss Rate measuremen	k in detal	a December Declared	included and the base	. Darkati ora Data	
in register value	Tame Bandwid	th in register value	Frame Bandwidt	h Packet Loss Kale	
	*)/ (DECEMBER +)	HITCHARD +) = 9,99*10	· 1
the Dipcounter Ether Transm	thed Packet Contract	Ether T	ranamitted Discarded Pac	tet 1 4.0105296	
Ether Receive	d Padkot	Ether R	eceived Discarcled Packet	HIGHLENDER	F Ston/
Specify and extinuitions	-				
how menute	loono interval 2	Step3	time obourdoyou o	ute O second	<u>n</u>
interval L second	1.000		_		26

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.

WТ	Serial number	Test date			
Test type	Test condition	Check item			Measured value
LED operation	Remove the AC	Confirm that the POW LED on the WT adapter goes out.			-
lesi	adapter.	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 L green.			
		Confirm that the ALM LED on the WT adapter flashes at 1-second intervals and then goes out.			
Loopback test between WT and		Confirm that the ETHER LED on the WT adapter goes out.			-
WT adapter	Press the TEST switch on the WT adapter.	Confirm that the ETHER I out.	LED on the WT adapter goes		
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

Table 7-1 Check sheet

8. Standard Tools to be Used

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

				1 10010 0000	
No.	Unit name	Used for:		Tightening torque [N•cm]	Tool
1		Door	M5	265	Torx driver (VESSEL T25H-120)
2		Power board	M4	127	Phillips screwdriver
3		Cable clamp	M4	118	Phillips screwdriver
4	AP-IFU	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		Small window	M4	127	Torx driver (VESSEL T20H-120)
7	WT	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)

Table 8-1 Tools Used

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.

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

Table 9-1 Initial values for AP parameters

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

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)				
	Initial		Parameter which can be set up	
Parameters Initial Setting rang		Setting range	Local manageme nt tool	PP-OpS
Registerd 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)

			Parameter which can be set up		
Parameters	Initial values	Setting range	Local management tool	PP-OpS	
Registerd 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 swiche	able 9-4 Initial value	es for AP-IFL	J 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)

				Parameter which up	can be set
	Parameters	Initial values	Setting range	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	invalid
4	Encryption parameter	10 blank characters	5 single-byte alphanumeric characters	valid	invalid
5	Send level	14dBm	-6 - +14dBm	valid	valid
6	Modulation method	16QAM	16QAM/QPSK/AUTO(reserved)	valid	valid
7	Interface	AUTO	AUTO/10BASE	valid	invalid
8	Radio frequency	Not set	Based on the registered ini file	valid	invalid
9	Master ATPC	OFF	OFF/ON	valid	valid
10	IP ADDRESS	192.168.1.100	0.0.0.0 - 255.255.255.255	valid	invalid
11	Subnet mask	255.255.255.0	0.0.0.0 - 255.255.255.255	valid	invalid
12	Default gateway	192.168.1.254	0.0.0.0 - 255.255.255.255	valid	invalid
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	invalid
15	OpS VID	0	1 -4094	valid	invalid
16	OpS priority	0	0 - 7	valid	invalid
17	ARP response	ON	ON/OFF	valid	invalid
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	invalid
21	Write community name	public	10 single-byte characters	valid	invalid
22	Trap community name	public	10 single-byte characters	valid	invalid

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

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

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

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

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

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

16					
WT	WT1	WT2	WT3		
ltem	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	

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



Point to Maltipoint 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

	WT1 (Master)	WT2 (Slave)	
ltem	Value	Value	Тооі
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
АТРС	off	off	Management Tool

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

Point to Point VLAN SW parameters



Figure 11-2 Point to Point VLAN SW parameters

OpS PC

JRC FWA SYSTEM Instruction Manual H-7YZCM0101B Rev. 3.4 24/SEP./2008 JRC Japan Radio Co., Ltd.