

ATTACHMENT E.

- USER MANUAL -

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RAS6000

Installation Manual

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Preface

Purpose of this manual

This document provides basic description on RAS 6000 System (Outdoor) which is used as base station for Mobile WiMAX (WiBro-Wireless Broadband service in Korea) System.

Hereafter we will call "RAS 6000 System (Outdoor)" "RAS" or "RAS 6000" for convenience' sake, and will call "RAS 6000 System (Outdoor)" when there's a specific need for distinction.

Specific documents are available on RAS System according to the subject. For detailed information on system operations or behaviors, refer to the following documents specific to the subject.

- I RAS Operations Manual
- I RAS CLI(Command Line Interface) Manual
- I RAS System Description

Updates and Changes

POSDATA maintains the manual updates so the document coincides with the changes made to the system, however, there may be minor discrepancies resulted in the process of system upgrade or error correction. If there's any confusion due to the system change or error correction, contact the address provided in the "Contact Information" section for the accurate information.

Copyrights

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Contact Information

If you want to find out more detailed information than the technical content this manual provides, please send your inquiry to the following address.

- I Address: 276-2 Seohyun Dong, Bundang Gu, Sungnam City, Gyunggi Do, South Korea
- I Telephone: 82) 031-779-2114
- I Web site : www.flyvo.com

Legend: Warning and Other Signs

Following signs are used in this manual.



Caution

Briefly explains the caution and the corresponding measures.



Information

Explains operational measures or help on the system.



FLYVO

The compound word of Fly + Voyage, FLYVO is the Mobile WiMax brand name of POSDATA.

Chapter I. Introduction

Major System Standards

Capacity

RAS6000 is capable of expanding and supporting from 1FA/3Sector up to 3FA/3Sector depending on the number of subscribers, volume of communication and place used.

Power

RAS6000 supplies power to the system by converting AC power input. When running on battery, it provides charged current to the system.

Item	Specification	Remark
Input Power	-48VDC (+27 VDC optional)	MSS
	-48 VDC	RSS
Power Consumption	-48V , 14A (MAX)	MSS, 3FA/3Sec (full set)
	-48V , 8A (MAX)	RSS
Battery Back-up Output Power	+21~+28 VDC	External Battery Rack (optional)

Dimensions & Weight

Item	Specification	Remark
Dimension (W x D x H, mm)	1150 x 600 x 800	MSS, Include plinth
	510 x 380 x 245	RSS, Include bracket and skirt
Weight(Kg)	150	MSS, 3FA/3Sec (full set)
	Less than 23	RSS

Environmental Standard

Specifications on temperature, humidity, altitude, vibration, acoustic noise, and EMI for system operation are provided in below table.

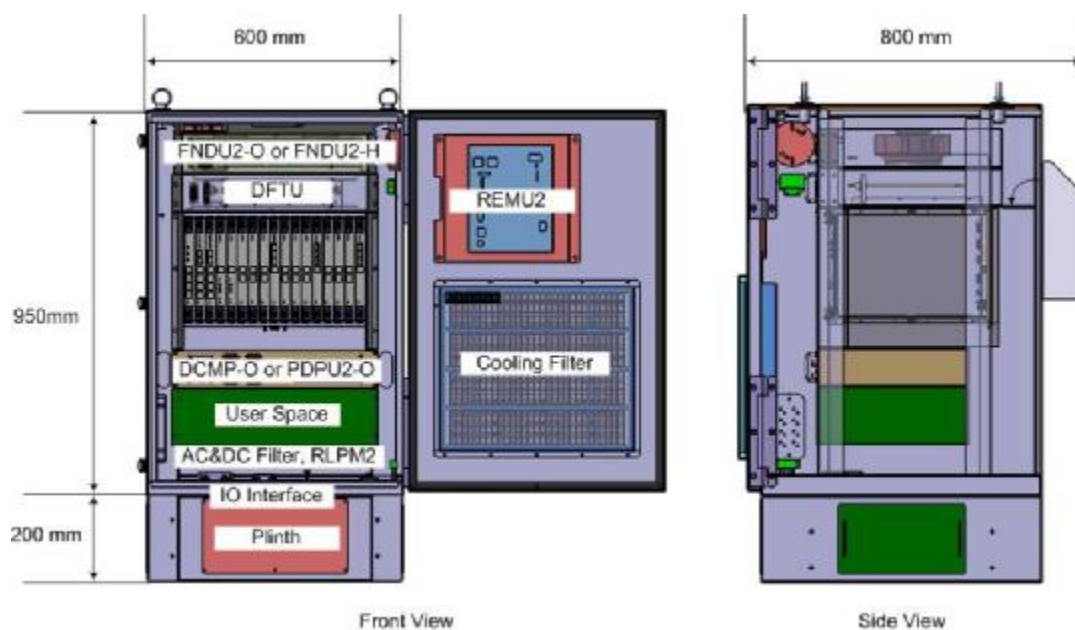
Item	Specification	Note
Operating Temperature	-30~50 °C	GR-63-CORE Sec.4.1.1
Storage Temperature	-40~70 °C	GR-63-CORE Sec.4.1.1
Humidity	5% to 95% up to 32°C and not to exceed 0.024kg water/kg dry air	GR-63-CORE Sec.4.1.2
Altitude	-60~1800 m (-197~5905 ft)	GR-63-CORE Sec.4.1.3
Vibration / Earthquake	-	GR-63-CORE Sec.4.4 GR-63-CORE Sec.5.4
Acoustic Noise	Less than height of 1 m, Dist. 1.5 m 65 dB	GR-63-CORE Sec.4.6 GR-487-CORE Sec.3.2.9
Particle Density	0~50 µg/m ³	GR-63-CORE Sec.4.5
EMI		Class A for KN22 (EN 55022, CISPR22)

System Exterior & Unit Composition

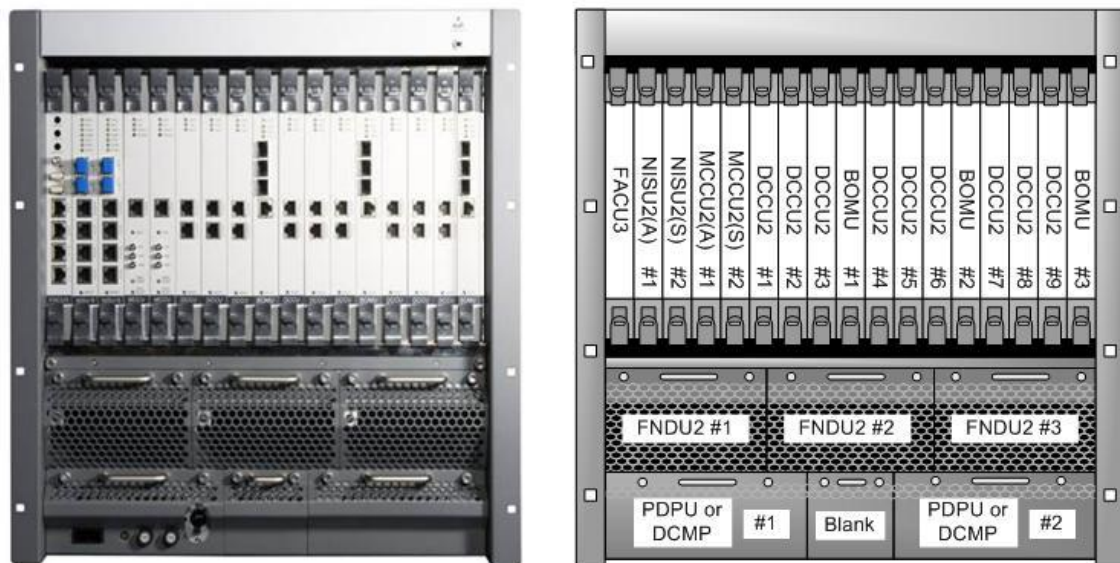
System Exterior

RAS6000 System consists of MSS (Main Sub System) responsible for WiMAX Digital Processing and RSS (Remote Sub System) in charge of RF signal processing.

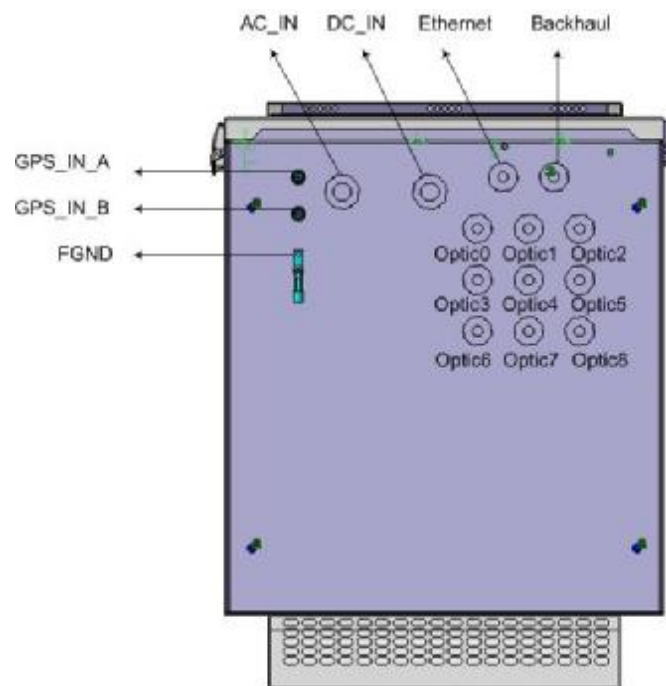
In order to maximize the stability and ease of operation, RAS6000 System reduced wiring to minimum by letting inter-unit connection pass through the backboard. Inter-unit connections using cable is wired in the front part.



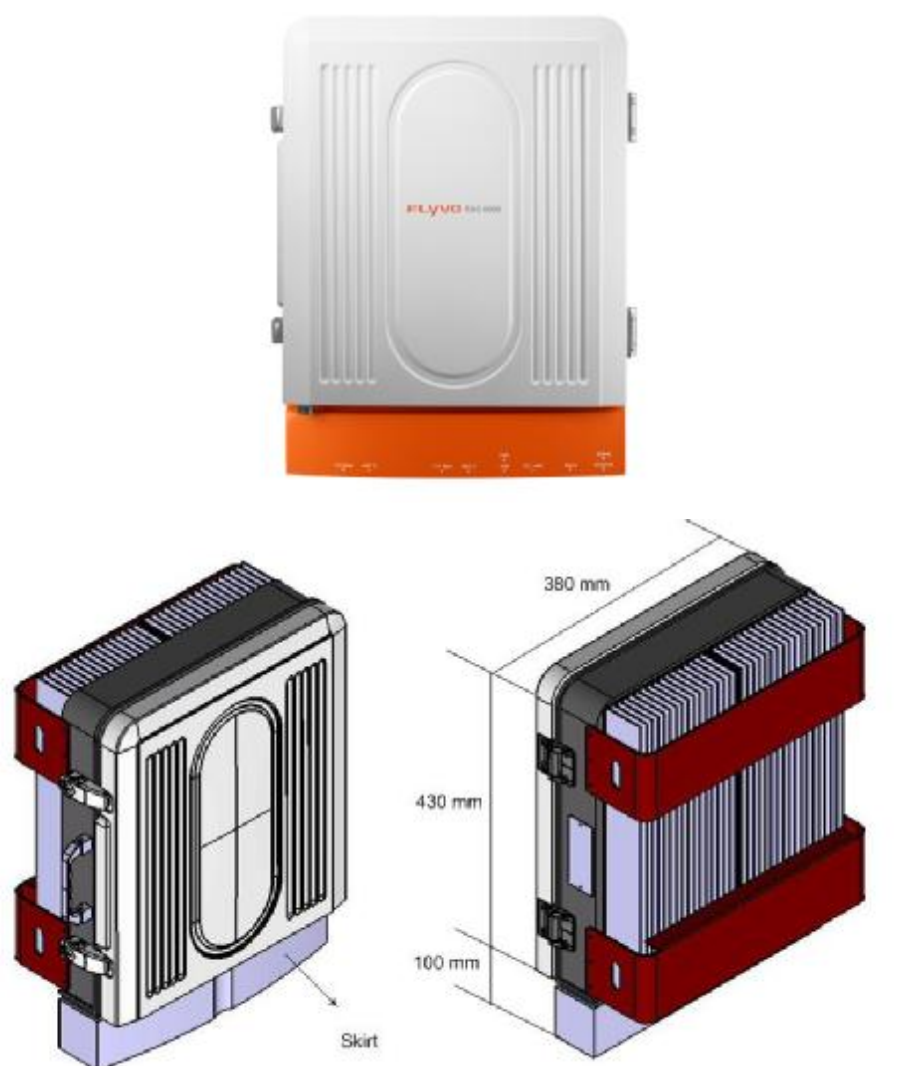
[Figure I-1] RAS 6000 MSS System Exterior



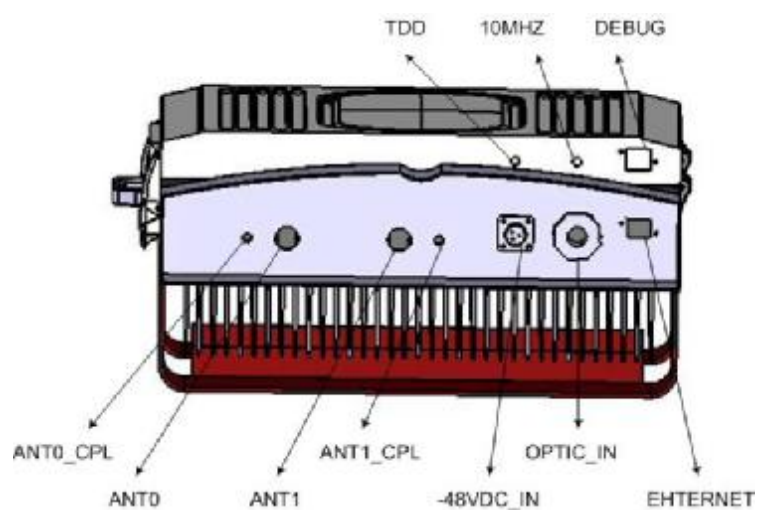
[Figure I-2] RAS6000 MSS System Block Plan



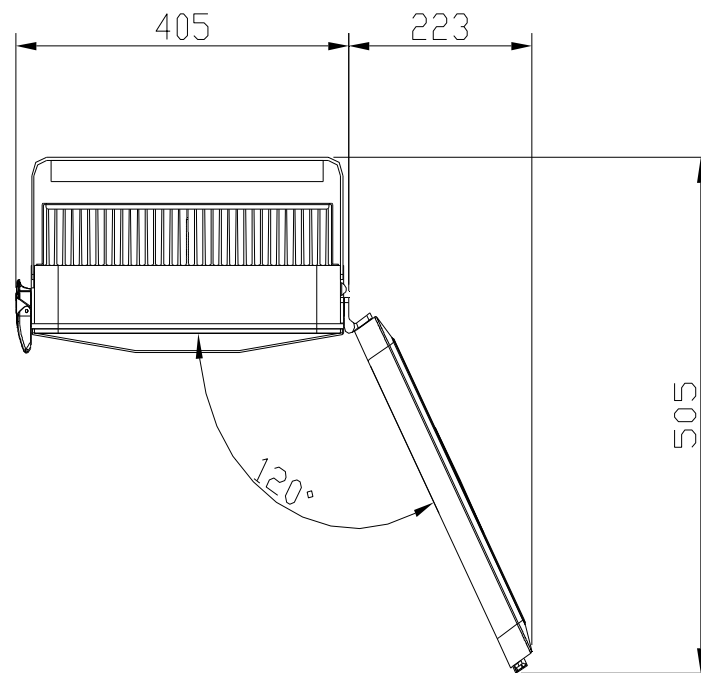
[Figure I-3] RAS6000 MSS System Bottom View



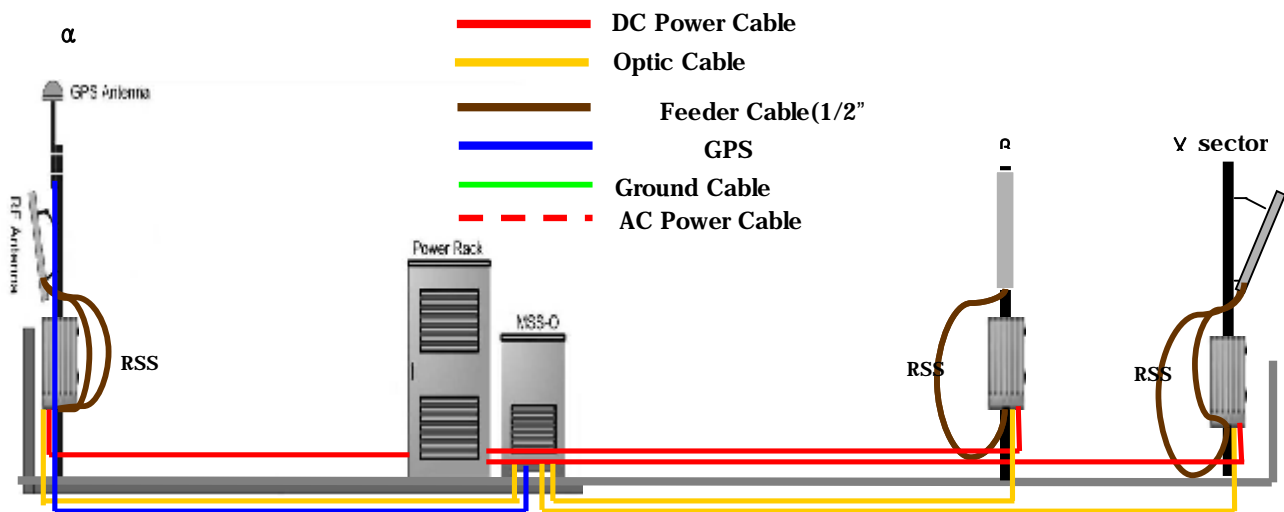
[Figure I-4 RAS6000 RSS External View]



[Figure I-5 RAS6000 RSS Bottom View]



[Figure I-6 RAS6000 RSS Door Open View]



[Figure I-7 RAS6000 System Deployment Example]

Unit Composition Table

RAS6000 System can support from 1FA/3Sec to 3FA/3Sec based on the preconditions and installation

environment.

Block	PBA / Unit	1Sector	2Sector	3Sector	Remarks
DU	NISU	1	1	1	
	MCCU	1	1	1	
	DCCU	1	2	3	
	TRXU	1	2	3	
	RIFU				Option
	FACU-M	1	1	1	
RF	RPAU	1	2	3	
	RFEU	1	2	3	
	RDTU				Option
HMS	FNDU	1	1	1	
	FNRU	1	1	1	
	RHEX	1	1	1	
Monitoring	REMU	1	1	1	
Power	PSU-M	1	1	1	
Cable Duct		1	1	1	Option

[Table I-1] shows unit composition according to number of Sectors.

Block	PBA / Unit	1Sector	2Sector	3Sector	Remarks
DU	NISU	1	1	1	
	MCCU	1	1	1	
	DCCU	1	2	3	
	TRXU	1	2	3	
	RIFU				Option
	FACU-M	1	1	1	
RF	RPAU	1	2	3	
	RFEU	1	2	3	
	RDTU				Option
HMS	FNDU	1	1	1	
	FNRU	1	1	1	
	RHEX	1	1	1	
Monitoring	REMU	1	1	1	
Power	PSU-M	1	1	1	
Cable Duct		1	1	1	Option

[Table I-1] Unit Composition per Number of Sectors

Physical Interface

MSS provides ACR Link and can be connected using UPT or Optic Link. MSS and RSS are composed of optic link, and MSS and RSS each provides SFP port.

Physical Interfaces of RAS6000 are as follows.

MSS Physical Interface

No	Name	Conn. Type	From	Cable Type	Qty	Max. Distance	Description
1	Backhaul for UTP Link	RJ-45	-	UTP	2 (4)		10/100/1000Base-TX
2	Backhaul for Optic Link	SFP	-	Single mode	2 (4)		1000Base-ZX/LX/SX
3	MSS-RSS Link	SFP	RSS α /1FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	RSS α /2FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	RSS α /3FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
4	MSS-RSS Link	SFP	RSS β /1FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	RSS β /2FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	RSS β /3FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
5	MSS-RSS Link	SFP	RSS γ /1FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	RSS γ /2FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	RSS γ /3FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
6	GPS Link	N(F)	GPS Ant.	Coaxial Cable	1(2)	Up to Cable	
7	-48VDC In	Type-O Lug	Rectifier	Copper AWG10		20m	Rectifier
8	AC In	Type-O Lug	AC				For Heater Option

RSS Physical Interface

No	Name	Conn. Type	From	Cable Type	Qty	Max. Distance	Description
1	ANT 0	N(F)	Ant.	UTP	2 (4)		10/100/1000Base-TX
2	ANT 1	N(F)	Ant.	Single mode	2 (4)		1000Base-ZX/LX/SX
3	RSS-MSS Link	SFP	MSS/1FA	Single mode	1	1 Km	1000Base-ZX/LX/SX
		SFP	MSS/2FA	Single mode	1	1 Km	1000Base-ZX/LX/SX Omitted if RSS for 1FA
		SFP	MSS/3FA	Single mode	1	1 Km	1000Base-ZX/LX/SX Omitted if RSS for 1 & 2FA
4	Rect. Alarm	RJ-45	Rect. For RSS	UTP	1	10m	Rectifier for RSS
5	-48VDC IN		Rec.	Copper AWG10			1) Rect. for RSS 2) Rect. for MSS & RSS

Chapter II. Preparing Installation

General Safety Measures

Installation Safety Rules

Following list describes safety rules against potential safety concerns at the time of installation.

- I Post a warning sign or set up a “no- entry zone” where high-tension electricity equipment or other potential danger exists.
- I Check the ground connection status before starting installation process.
- I Verify that power is turned off. If installation needs to be performed at nighttime, prepare proper lighting to prevent safety concerns.
- I Use protective accouterment when drilling holes on the wall or ceiling.
- I When using lifting equipment or crane, supporting personnel other than system operator shall make preparation against falling and other safety accident.
- I Find out safety load on lifting equipment and crane. Make sure not to overload the equipment.
- I Do not wear accessories such as wristwatch or rings to prevent electroshock caused by metallic items.
- I Find out the locations of fire-warning facility, fire extinguisher, and exits and become familiar with the instructions.
- I Do not perform installation alone.

Safety Rules against Electrostatics

When handling electrostatic-sensitive items, observe following instructions to prevent damages on various product components.

- I All units related to electric circuit must be handled after wearing a wrist strap and connecting it to ground.

- I All units associated with electric circuit must be isolated from electrostatic inducible materials such as plastics, acrylic board, paper, and Styrofoam.
- I All units associated with electric circuit must be stored in antistatic vinyl pack or storage compartment.
- I Place where equipment resides must maintain 40~70% humidity level in order to prevent electrostatics.

For reference, electrostatic damage per component is as follows

Type	Voltage Damage(V)
MOSFET	100 ~ 200
JFET	240 ~ 10,000
CMOS	250 ~ 2,000
TTL	250 ~ 2,000
Bipolar TR	300 ~ 2,500
ECL	500 or above
SCR	680 ~ 1,000

Installation & Workspace

System is designed with front & rear opening and closing, therefore, minimum space for system opening and closing needs to be procured as shown in below illustration.



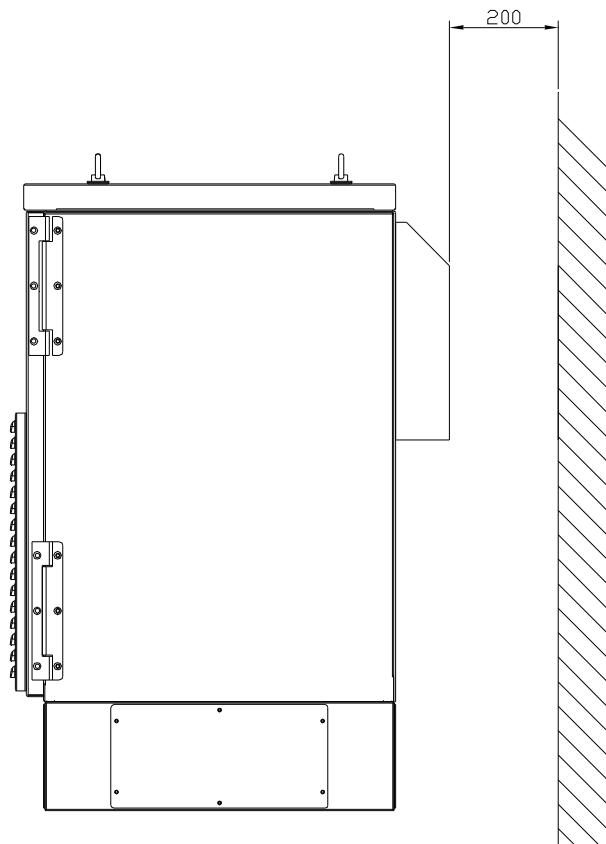


Figure II-2 MSS Side View

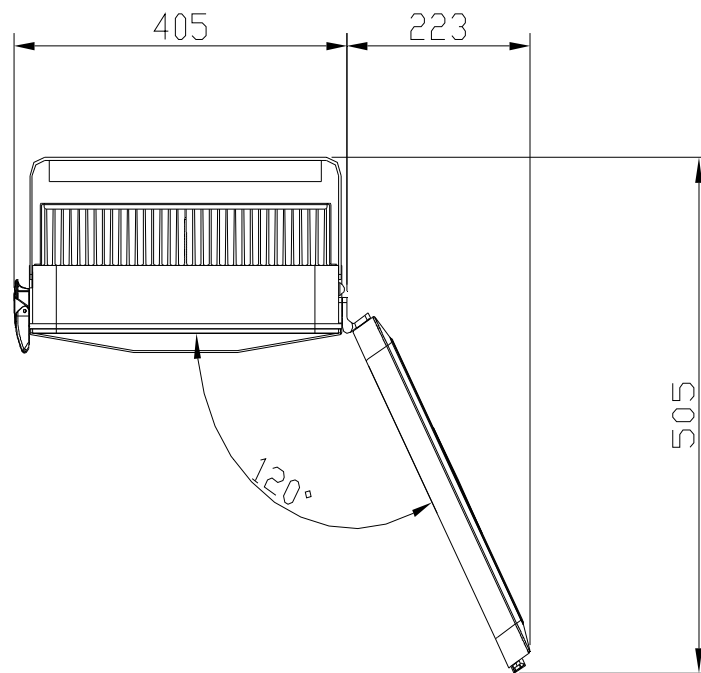


Figure II-3 RSS Door Open View

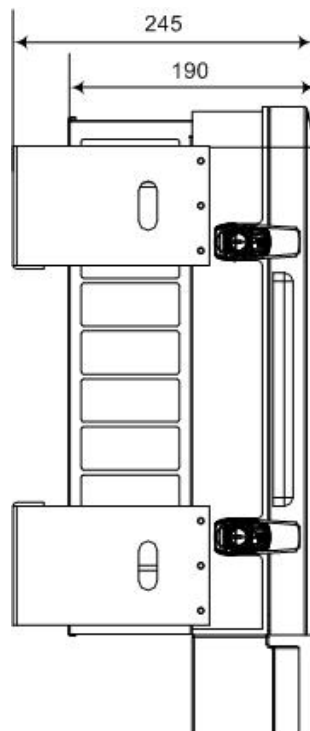


Figure II-4 RSS Side View

Therefore, when positioning this equipment spatial requirement for opening & closing of front door needs to be considered as well as relationship with adjacent equipments.

On-Site Survey

Items to Verify

Service provider operating RAS equipment and personnel in charge of installation must conduct an on-site survey prior to equipment installation.

When conducting an on-site survey, prepare a plan of the station where system will be installed, perform prior confirmation on important details such as mechanical factors, electrical factors, and location of antenna deployment. Also, verification needs to be conducted on supplementary factors listed below.

- I Suitability of installation space & workspace
- I Verification on route and method of system transportation to the installation site
- I Equipment installation space & orientation
- I Necessity for installing lighting equipment
- I External interface status
- I Power capacity & wiring status
- I Feasibility of system expansion
- I Location for antenna deployment (Tower or Wall) & wiring method
- I Supplementary equipment environment (Rectifier, Battery, etc)
- I Surrounding factors influencing safety of installation personnel
- I Place to dispose wrapping waste

On-Site Survey needs to be conducted based on an inspection checklist.

NO	Division	Inspection Item	Result	Note
----	----------	-----------------	--------	------

1	RAS Type	RAS Type (Omni, Sector)		
		RAS Qty (Total Rack Qty)		
2	Building	RAS Installation site address		
		Building Type (Telephone Office/Apartment/Office,etc.)		
		Total number of stories		
		Floor where installation will take place		
		Flooring Status (Load problem)		
		Floor leveling status		
3	Power Check	Capacity & quantity of rectifier		
		Incoming AC power capacity (Phase/Wire/Volt)		Length(M) of Power Line
		Qty/Capacity of Break Switch in the AC distribution box		
		Main Grounding Box connection status		Length(M) of ground wire
4	Interface Check	Transmission Equipment Status		
		Cable connection terminal		Length(M) of Junction cable
		RF cable path inspection		
		GPS antenna attachment (pylon/pole)		
		RF cable length		
		Existing pylon or pole Status		
		Height of existing antenna (CDMA adjacent antenna)		
5	Transportation Check	Sytem transportation path		
		Whether there's stairs (width : over 2 M)		
		Check fright elevator (load 300 kg)		
		Whether use of crain is feasible		
		Whether Crane needs to be brought through window		

Reports to Prepare

Following reports need to be drawn based on the results of On-Site Survey.

- I Machinery positioning map
- I External interface method & problems
- I Job drawing
- I Cable rack installation drawing

- I Power cabling drawing
- I Earth cabling drawing
- I Feeder Line & GPS cable installation drawing

Foundation Construction

The RAS6000 equipment is usually installed on the roof or outdoor. Floor surface construction, ground connection for equipment protection, and equipment fixation devices are required for such installation.

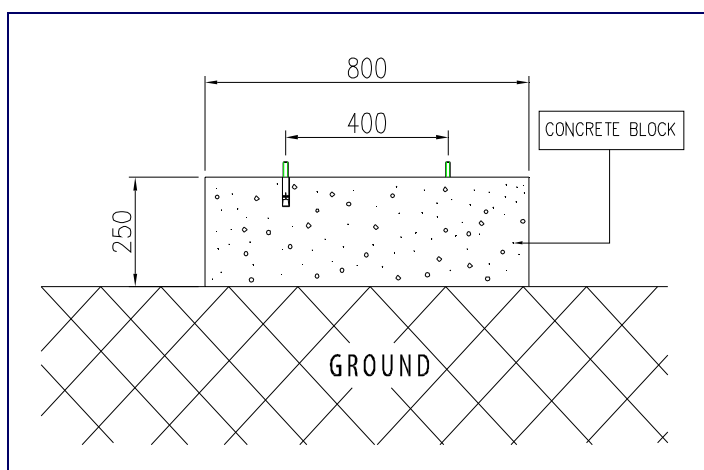
Floor Surface Construction

RAS6000 equipment is usually installed on rooftop or outdoor location. Method to support this type of installation is as follows.

Installing Concrete Structure

Concrete structure needs to be installed on a ground or outdoor place rather than in a building and minimum installation of concrete structure is illustrated below.

I Front View

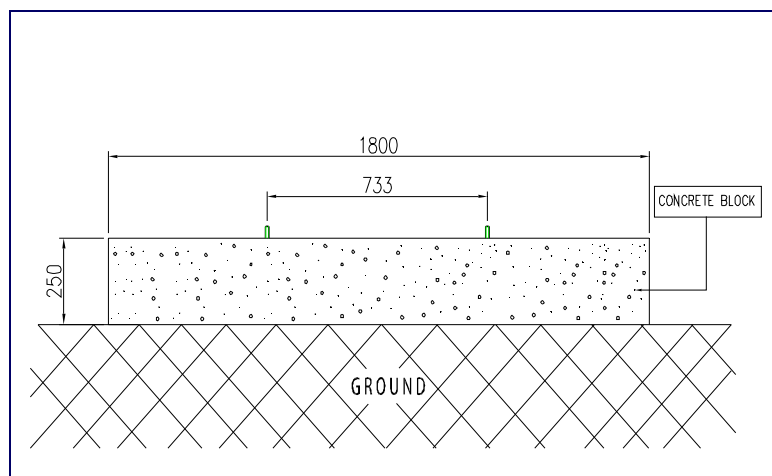


- FRONT VIEW -

1. Concrete Block Size needs to be minimum 250mm (height) x 800mm width).
2. Distance between Anchor Bolts needs to be exactly 400mm.

[Figure II-5] Front View

I Side View / Elevation

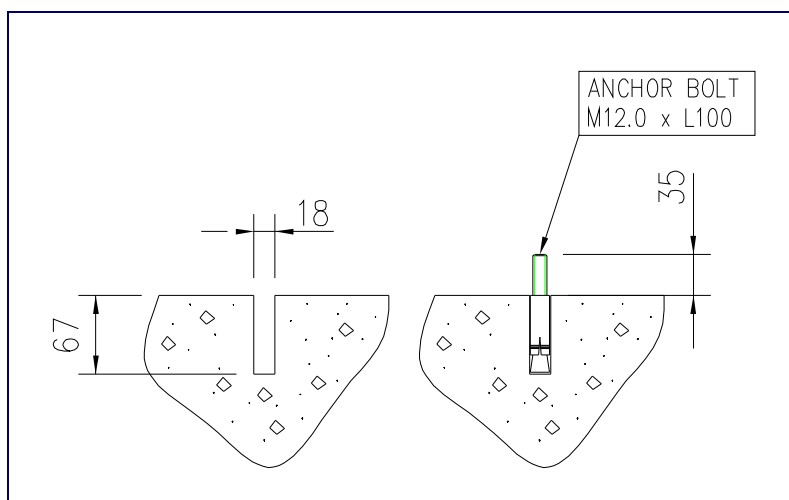


[Figure II-6] Side View

- SIDE VIEW -

1. Concrete Block Size needs to be minimum 250mm (height) x 1800mm width).
2. Distance between Anchor Bolts needs to be exactly 733mm.

I Anchor Bolt Installation



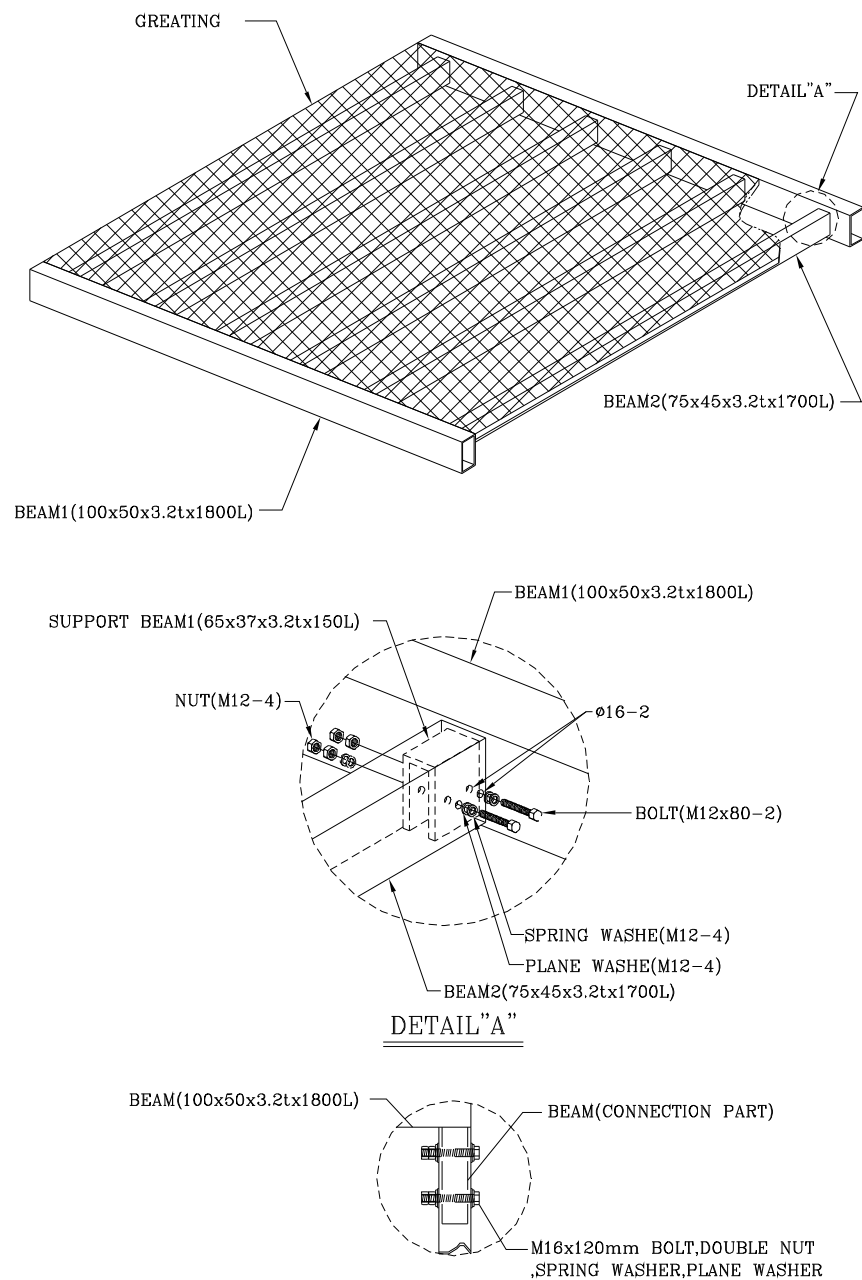
1. In Concrete Block drill a hole with 18mm in diameter and 67mm in depth.
2. Install Anchor Bolt (M 12.0 x L 100).

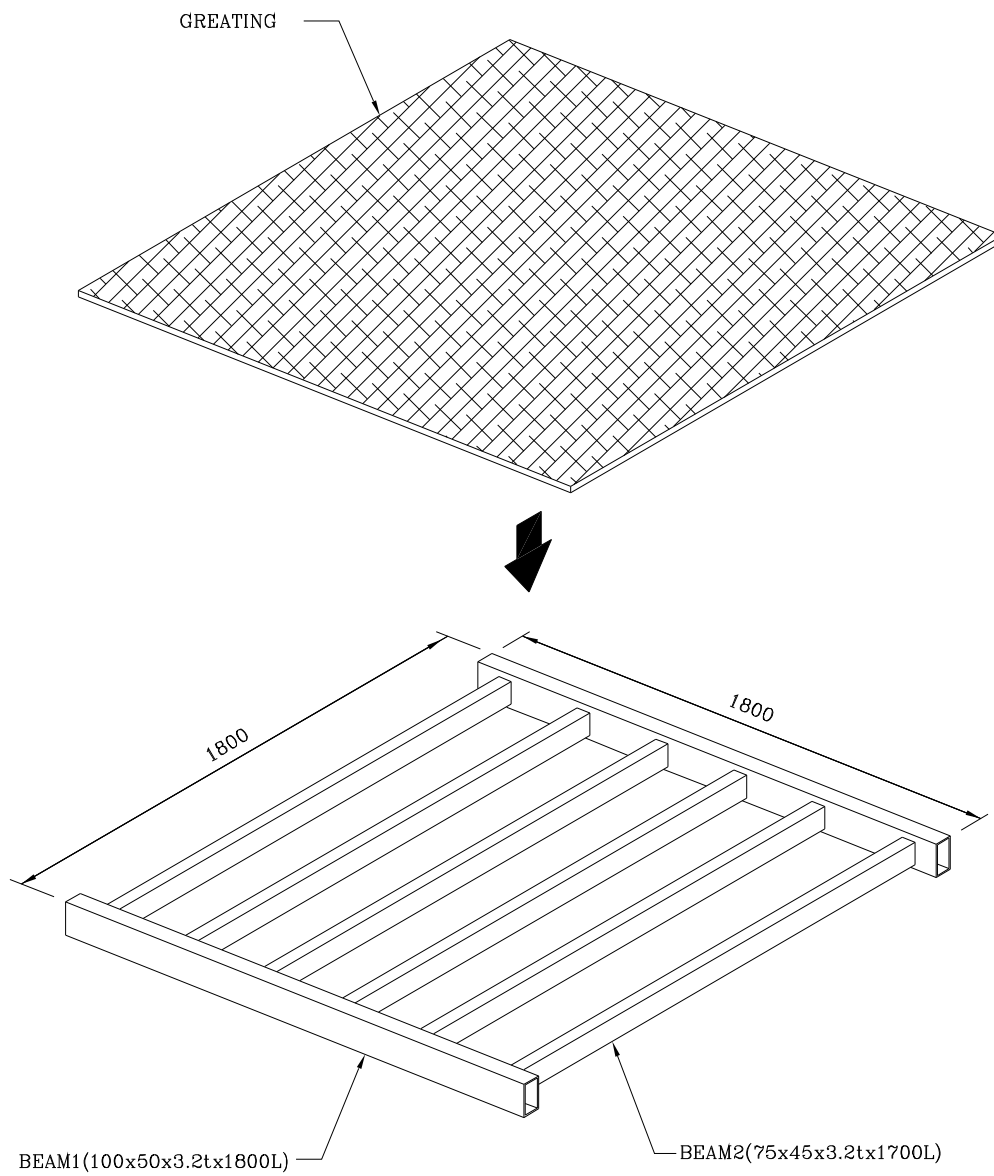
Installing Loading Distribution Pad

Loading distribution pad is required when equipment is installed on the roof of a building especially for roof having low weight resistance.

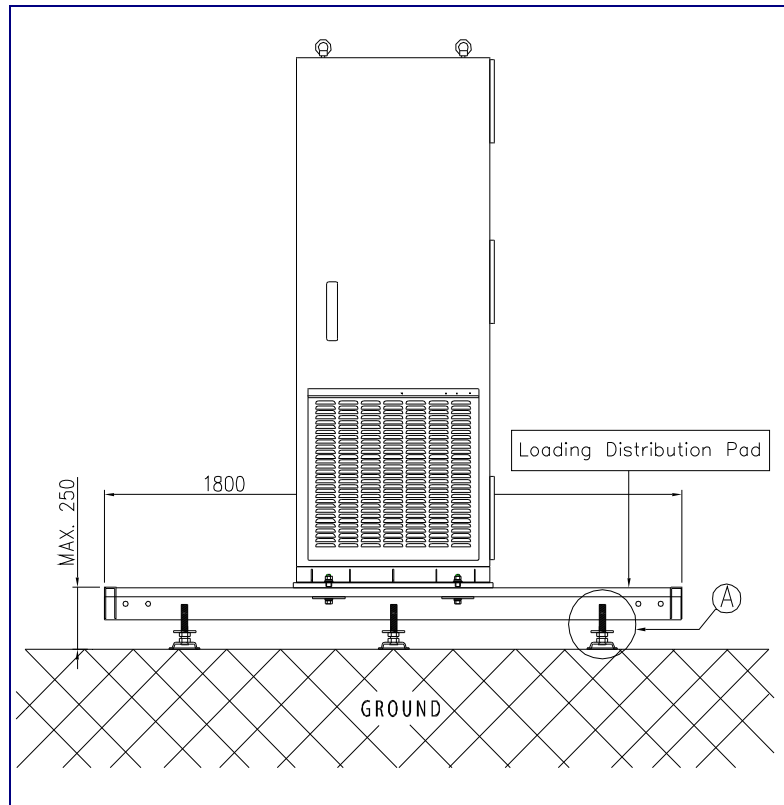
Loading distribution pad is a device that distributes the load on the building to be less than 250 kg/m².

It needs be installed when system weighs over 250kg per m². Installation instruction is as follows.



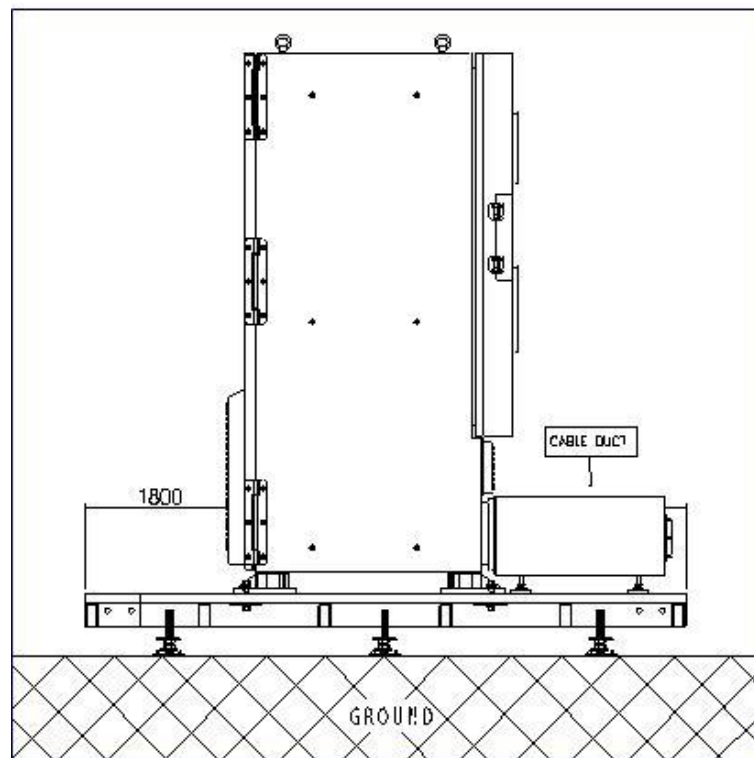


I Front View



[Figure II-7] Front View of Load Distribution Pad

I Side View



[Figure II-2] Side View of Load Distribution Pad

Grounding

Grounding work protects system from thunder, surged electric pressure, and high-frequency electric pressure & current, and protects system operator as well as system itself by providing path for electric discharge.

Ground wiring is better to be short and thick and the main requirements are as follows.

- I Ground wire laying depth: 75cm or above
- I Resistance value from earth
 - ü RAS: 5 Ω or less
 - ü Thunderbolt arrester grounding : 10 Ω or less
 - ü Antenna tower grounding: 10 Ω or less



Rigorous Grounding Verification

Grounding verification is the most important means to protect system and operator from electroshock. Strictly verify installation status after completion of grounding work.

Equipment Transportation

Cautions when transporting the equipment

Directions indicated outside of the package must be observed when transporting rack or other materials. When top & bottom is indicated, make sure not to carry the box upside down.

Mechanical shock, which may be caused during transportation, must be minimized. Acceptable shock regulation is as follows.

I Packaged Equipment

Weight(kg)	Falling Height(mm)
Less than 320	300

I Unpackaged Units & Supplementary Materials

Weight(kg)	Falling Height(mm)
------------	--------------------

0~10	100
10~25	75
25~50	50
Above 50	25

- ▮ Vibration standard during transportation: When transporting system, fasten the equipment tightly in order to maintain the vibration range of 1~500 Hz.

Preparation for Carrying In the Rack

Before bringing in and unpacking the rack verify following items.

- ▮ Verify materials, quantity, articles listed on work specification and possible damages on them in order to prevent hindrance to work process.
- ▮ AC power cable, DC power cable, Switches, and conduits for system or lighting installation must be standardized goods suitable for electrical specifications
- ▮ Before commencement of work, building pass need to be granted to allow entrance of construction personnel to the station.
- ▮ For interface with existing communication system, prior consultation with operation department and management department is required.

Carrying in Procedure

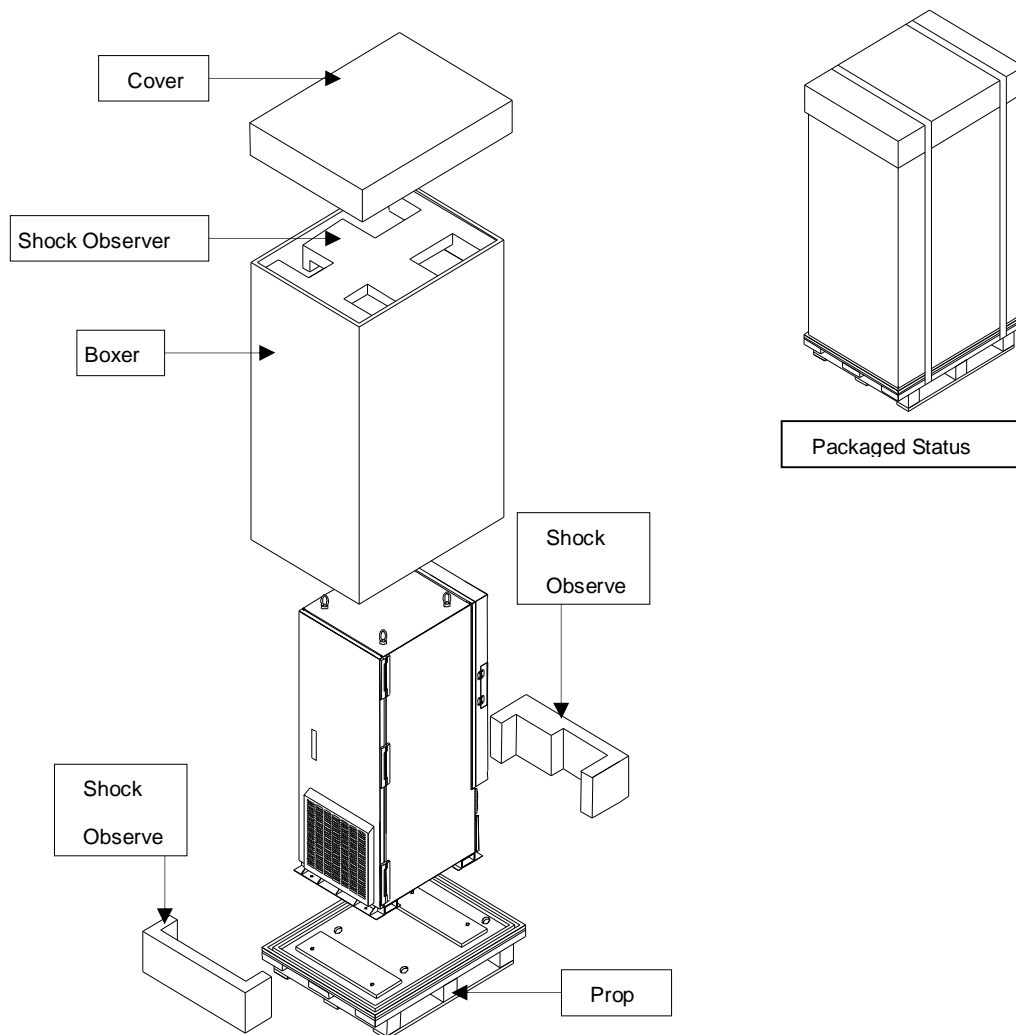
- ▮ When carrying in items, confirm the transportation path considering the weights and sizes. Check the width and height of each entrance at the same time.
- ▮ When carrying in items, be careful not to damage entrance, walls, pedestal of column, etc.
- ▮ When transporting units related to circuit, keep the package intact and open the package at the time of installation testing.

Unpacking

Cautions

- I Keep the package sealed until the item is transported to installation site.
- I Sort items by job specification and keep them in a location that doesn't obstruct the installation work.
- I Racks must be installed immediately after unpacking. If for some reason prompt installation is not possible, store them temporarily at the installation site. In this case, racks must be placed in a way that falling of one rack doesn't cause chain reaction on other racks.
- I Remove only the external packaging at first. Arrange items in the location of installation and then remove the inner wrapping.
- I Safely collect by-products at a designated place and return them to the operations division.

Rack Unpacking



[Figure II-3] Opening Rack Package

Steps for opening Rack package are as follows.

Check the packaging and make a note if there's a problem. If then, report the problem to responsible personnel or call the provided contact number for countermeasure.

Remove hexagonal nut from the bottom of wooden box.

Remove wooden box as shown in [Figure II-3].

Take out the rack from wooden prop by lifting it upward.

Remove vinyl wrapping and Styrofoam (Shock Buffer).

Compare actual contents to the list on the box or to the list provided separately to conform that both match.

Check if there's any damage on the items. If damage is found, contact responsible personnel or provided contact number for countermeasure.

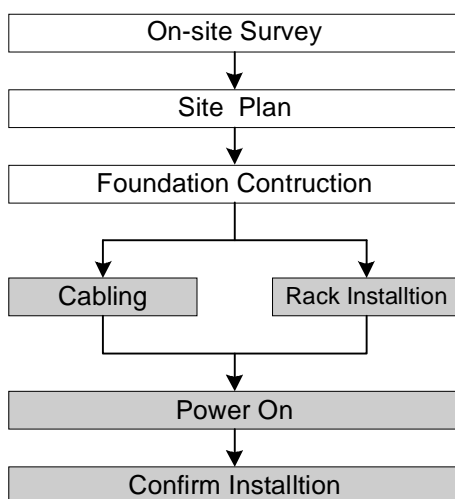
Take removed packing materials to waste storage or designated place for proper disposal.

Chapter III. System Installation

This Chapter provides instructions on actual installation of equipment after foundation construction is completed and system is unpacked.

Overall Procedure

Overall system installation process is as shown in the figure below. Contents described in this chapter are indicated with a shaded box.

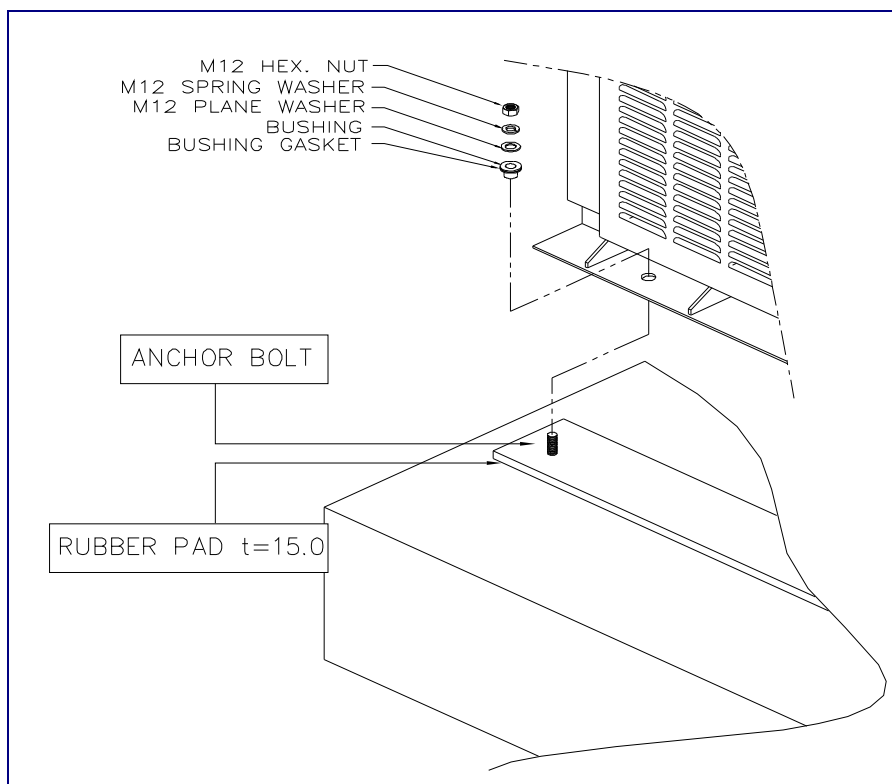


[Figure III-1] System Installation Procedure

Detailed Installation Process

MSS Rack Installation

Fixing Rack on Concrete Block



[Figure III-2] Rack Fixation Method-Concrete

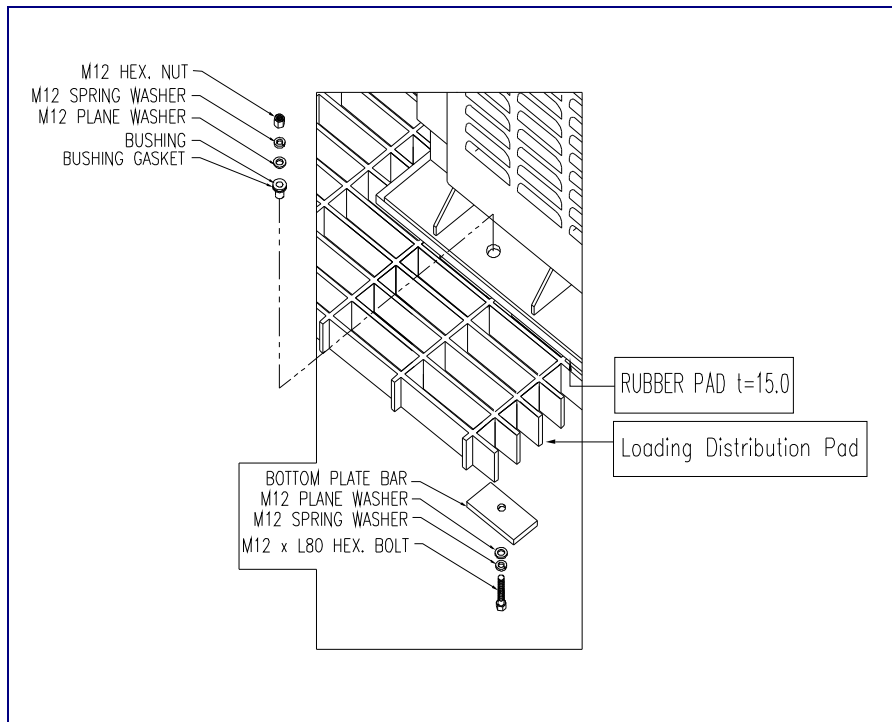
Above drawing illustrates equipment fixation on concrete structure. In order to completely fix the equipment against vibration such as earthquake, washer and the likes need to be used and the given order must be observed.



Equipment Weight Caution

Equipment is extremely heavy. When lifting or moving it, several people need to lift it together. Be extremely careful not to get the foot under the equipment.

Fixing Racks on Loading Distribution Pad



[Figure III-3] Way to Fix Rack on Loading Distribution Pad

When installing equipment on the roof or structural element of the building, Loading Distribution Pad needs to be installed in order to prevent damage to the building due to weight of the equipment. Insert nuts & bolts from bottom side and assemble with head of the bolt facing down. Assembly order must be observed as in fixing equipment on concrete structure.

Shelf Installation

After installing Rack, put the shelf into the rack from front and slide it in slowly. Using bolts to fix it on the left and right wings located in the front side.

When fixing with bolts, watch the balance of shelf as you fasten the bolts and adjust them multiple times to keep the best balance rather than tightening the bolts at once.

RF Antenna Deployment

2 RF Antennas are installed per sector (or cell). One of them has 2-way feature (Transmission & Receiving) and the other has only the receiving feature (for channel path diversity).

For channel path diversity and interference, 2 antennas should be placed with a minimum physical distance between them. Following is the standard formula for the distance calculation.

$$\text{Isolation} = 22 + 20 \log(s/\lambda) - (G1 + G2)$$

S: Distance between antennas

λ : Wavelength

G1 : Interferer's (Front Back ratio – Gain)

G2 : Interference receiver's (Front Back ratio – Gain)

Following is the properties of antennas used in current FLYVO system.

I Isolation = 20dB

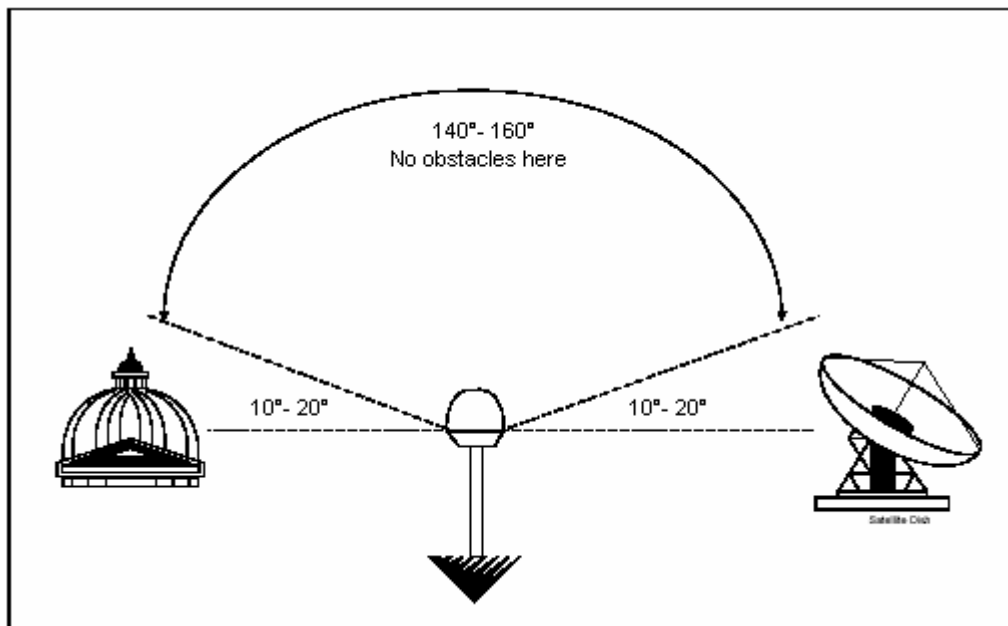
I G1 & G2 = 8dB

Considering the factors listed above, minimum distance between 2 antennas under frequencies used in WiMAX is as follows.

I 2.3GHz : 65cm

I 2.5GHz : 60cm

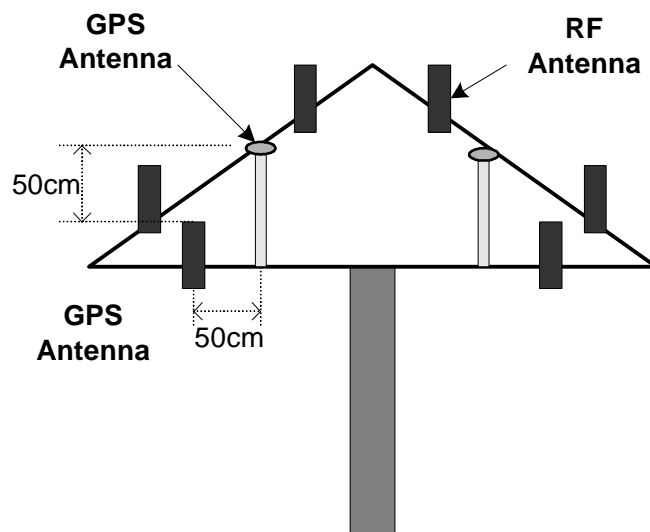
GPS Antenna Deployment



[Figure III-4] Conditions for GPS Antenna Deployment

As shown in [Figure III-4], GPS antenna must be deployed forming over 10 ° angle with ground surface to receive signals from satellite and should be kept free of obstructions blocking the electric waves.

When deploying together with RF Antenna, install at a minimum 50cm distance and 50cm higher than the RF Antenna.



[Figure III-5] RF & GPS Antenna deployment example

Cable Installation

There are cables inside the rack (Internal Cables) and cables outside the rack (External Cables). Internal Cables are already installed at the time of shipping so we will provide instructions on external cable installation only.

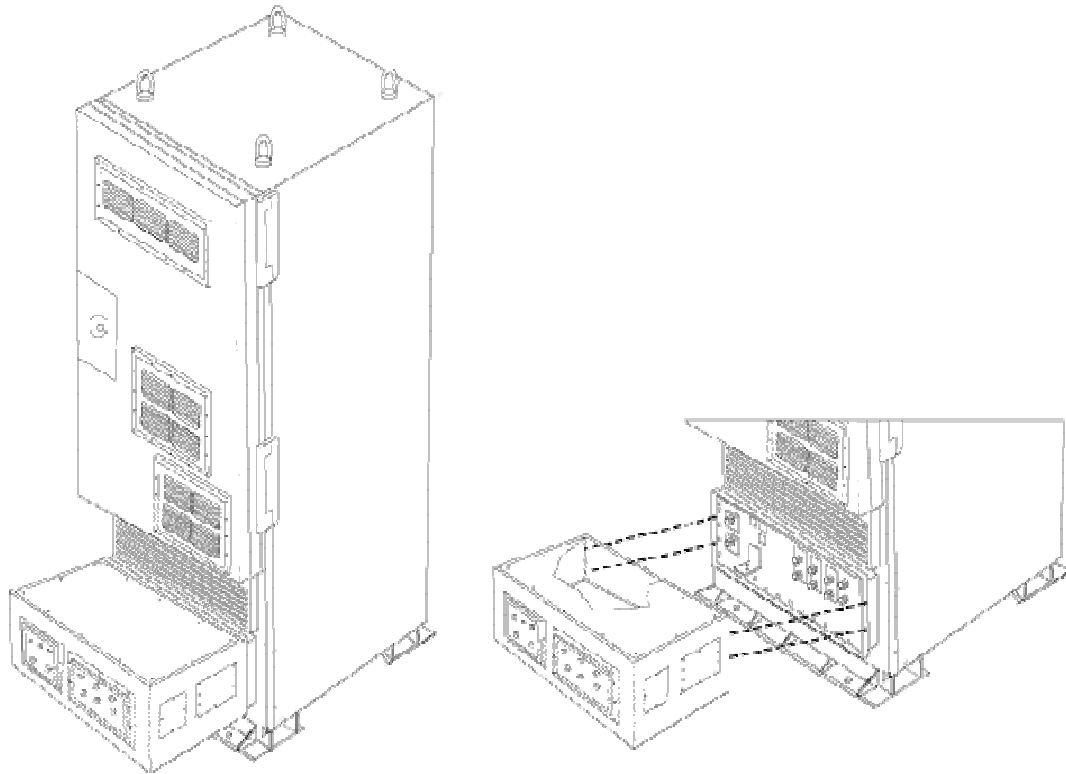
External Cables are connected to a cable duct located on the back of equipment and the cable duck has a built-in circuit protecting from surge that may be coming from external interface.

External Cables consist of

- I Power Cable
- I Trunk Cable
- I RF Cable
- I GPS Cable
- I Other Cables for Equipment

Cable Duct Installation

Cable Duct is a device that protects cables connected to exterior of RAS and it is mounted on I/O panel located in the lower part of RAS system's rear side.

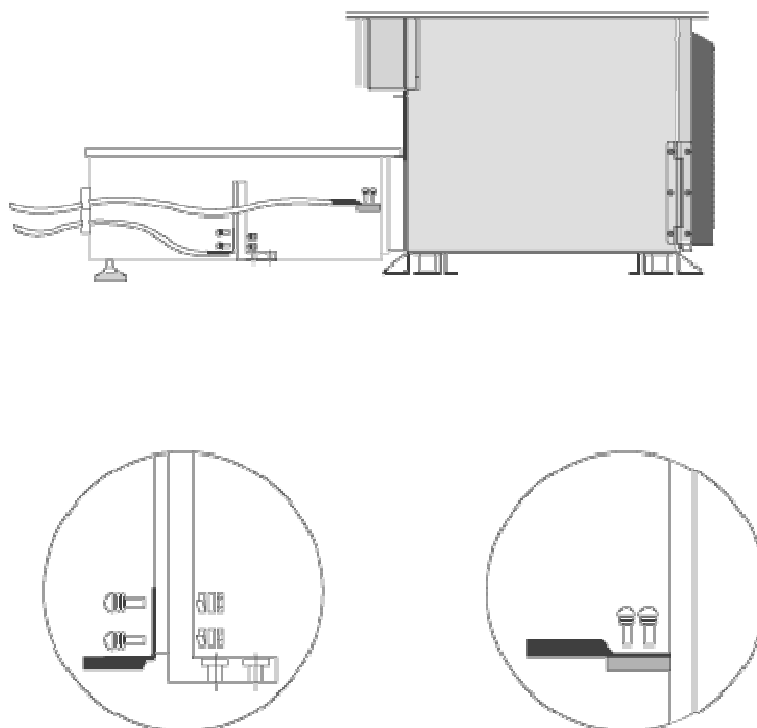


[Figure III-6] Cable Duct Assembly

Follow below instructions for Cable Duct Assembly.

- ① Adjust the height using the foot located under cable duck in order to line up M5.0 Tap on the rack with the holes on the cable duct.
- ② After adjusting the height of cable duct, fix cable duck and the rack using M5.0 X L12.0 bolts.
- ③ After completion of cable work, line up cable duct cover with M4.0 Tap in the cable duct, and fix them using M4.0 X L8.0 bolts.

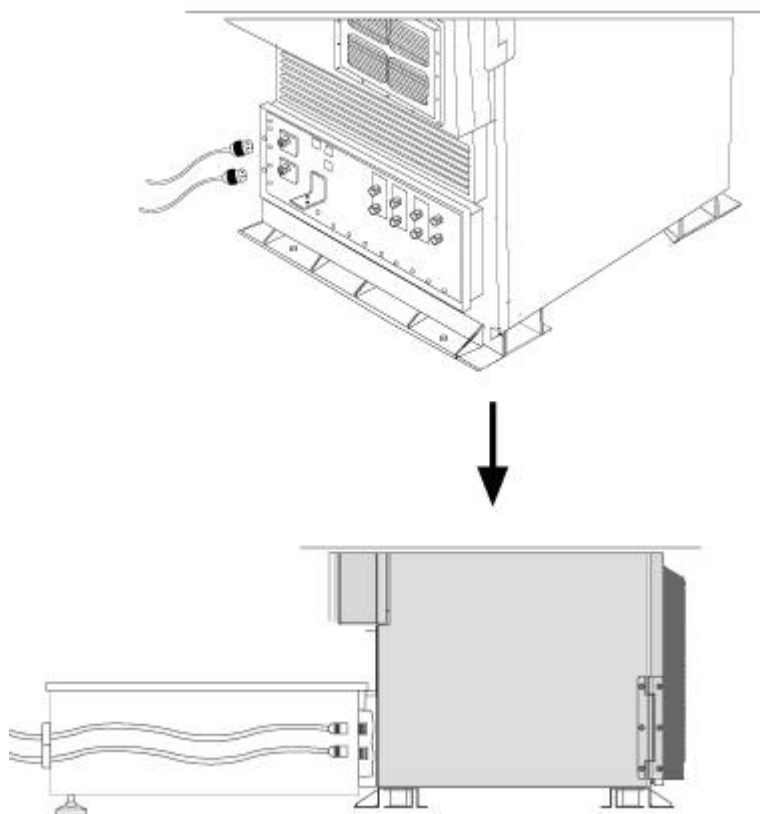
[Figure III-7] shows the cable duct assembly method and cable wiring.



[Figure III-7] Cable Duct Assembly & Wiring Diagram

Power Cable Installation

In below illustration, Power Line is connected through a cable duct.



[Figure III-7 Power Line Connection Drawing]

Following is the requirements on power cable.

- I AC (220 V) Input Power Cable
- I Cable diameter : Minimum 8 AWG
- I Connector Type : MIL-C-5015, M-S Connector, MS3106 Straight Plug, MS 20-19 (male)
- I Connector Pin Map : A (Line), B (Neut.), C (Power GND)

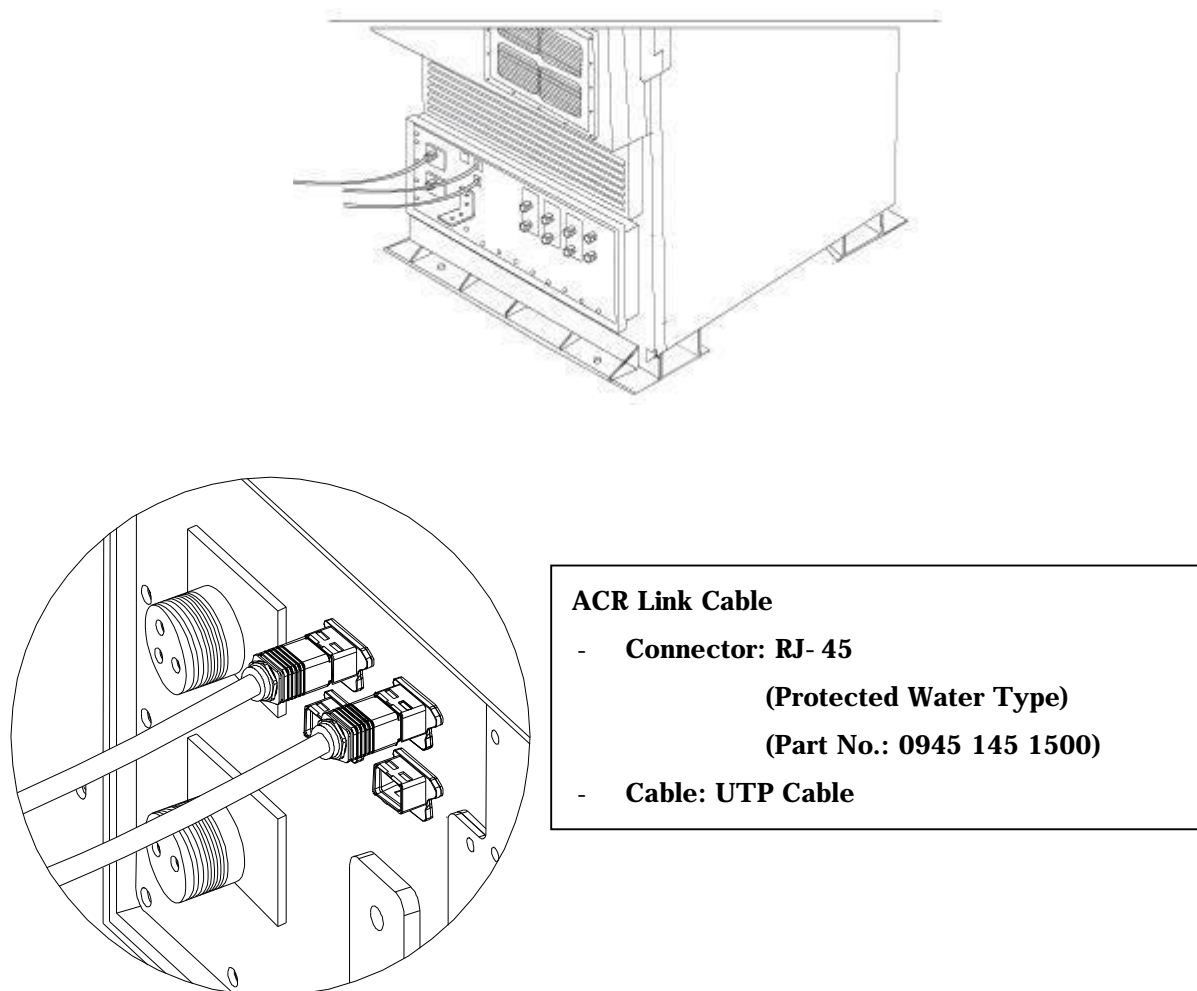


Confirm plug insertion status

Insert plug and turn it clockwise direction until full linkage is made. (If it is not linked completely, water leakage can cause short circuit.)

ACR Link Cable Installation

Link cable to ACR is connected through Cable Duct as shown in the figure below.



[Figure III-8] ACR Link Cable Connection Drawing

1) RF & GPS Cable Installation

Basic procedure for Cable Installation is as follows.

1) General Items for Cable Installation

I Path Examination

Examine cable installation path by following steps.

- ü Find out cable installation path from Pylon Antenna to RAS System.

- ü Select the path that can minimize the length of cable.
- ü Select the path that causes no damage or obstructions for cable installation.

I Cable Selection

Signal attenuates as it travels through cable. Depends on the cable type and manufacturer, cable attenuation differs. Accordingly, attenuation rate must be considered at the time of cable selection.

Below table shows the attenuation rate on most widely used GPS cables. The value represents the attenuation rate of signal strength per meter.

Cable Type	Attenuation Rate
RC8	0.31 dB/m
RG58	0.63 dB/m
RG213	0.35 dB/m
RG214	0.328 dB/m
LMR400	0.203 dB/m

I Cutting

Cable cutting encompasses calculation of exact cable length required and cutting of cable using a hacksaw or appropriate tools.

When cutting cable, pay attention to following details.

- ü Cut the cable to the exact length calculated.
- ü Mark the cutting points and cut the cable neatly so the sections would form perfectly square angles.
- ü Tilt the cable at the time of cutting in order to prevent penetration of moisture, iron, lead, debris, dust, or other foreign substances.
- ü Use hacksaw or file to cut the cable.
- ü Using solvent, wipe the cutting plane clean.
- ü Using a brush, wipe off the corners of cable.

I Cable Installation

Following is the instruction for Antenna Cable Installation.

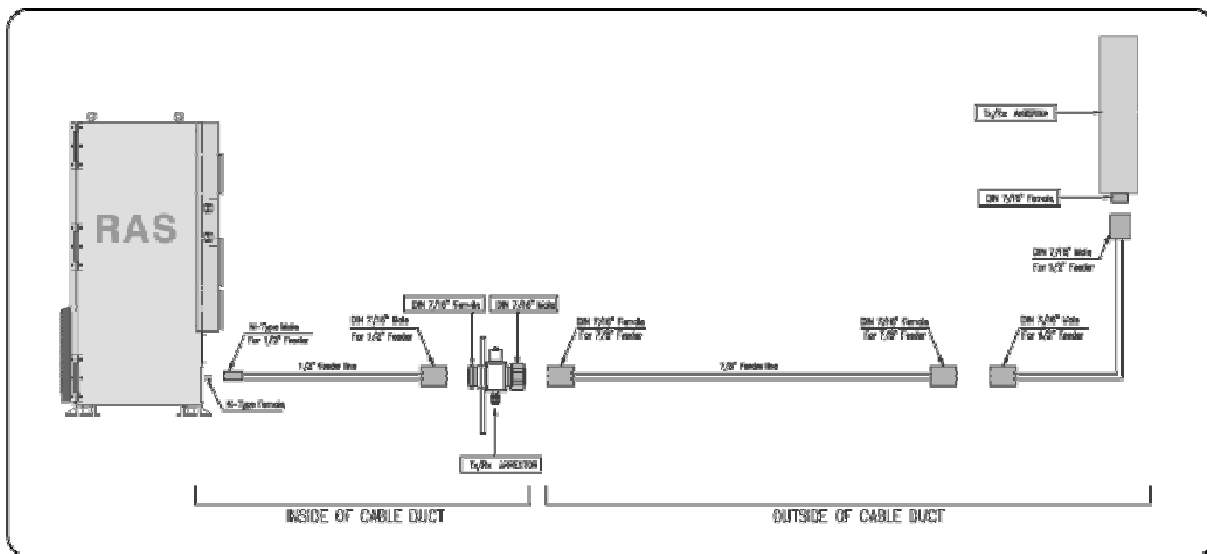
- ü Connect cable from the Antenna on Pylon to Arrestor.
- ü Connect Arrestor to Main Grounding Box (MGB). Then take the cable from arrestor and connect with cable joint of RAS.
- ü In case Antenna Cable needs to be brought in to station, use common duct in the station. If common duct doesn't exist, bring it in through window.

Special cautions to be taken for cable installation are as follows.

- ü Place a mat before working with cables to protect cable surface. If damage is found outside the cable, cut out the damaged part before installation.
- ü After connecting antenna and cable, finish with heat shrink tube to protect joints.
- ü Attach indication tapes on both ends of cable for ease of identification.
- ü When fixing cables with clamp, keep the distance between the clamps to 1.5m.
- ü When connecting cables to Rack, Antenna, or Arrestor in machinery room, firmly tighten the cables to prevent outbreak of reflected waves.
- ü Use jumper cables for connections between Rack and Arrestor, and between Antenna and 7/8" cable. Make sure that jumper cables are not entangled.
- ü Radius of curvature should be as big as possible, and wiring has to be performed with at least a minimum radius of curvature.
- ü Make sure that cables are not disturbed by passage of people or equipment such as pylon ladder.
- ü Link connector to antenna in a straight line. After linkage is made, be careful not to put excessive pressure.
- ü Use Vinyl tape for use of electrical equipment (Vinyl tape hereafter) and heat shrink tube on Connector's external exposure in order to prevent water leakage.
- ü Wrap around with vinyl tape more than twice and with self adhesive rubber tape more than 3 times on connector's joints and then cover with heat shrink tube.
- ü When connecting with 1.2" and 7/8" cables, widen the joining part of 1/2" cable to 7/8" using vinyl tape and cover with heat shrink tube.

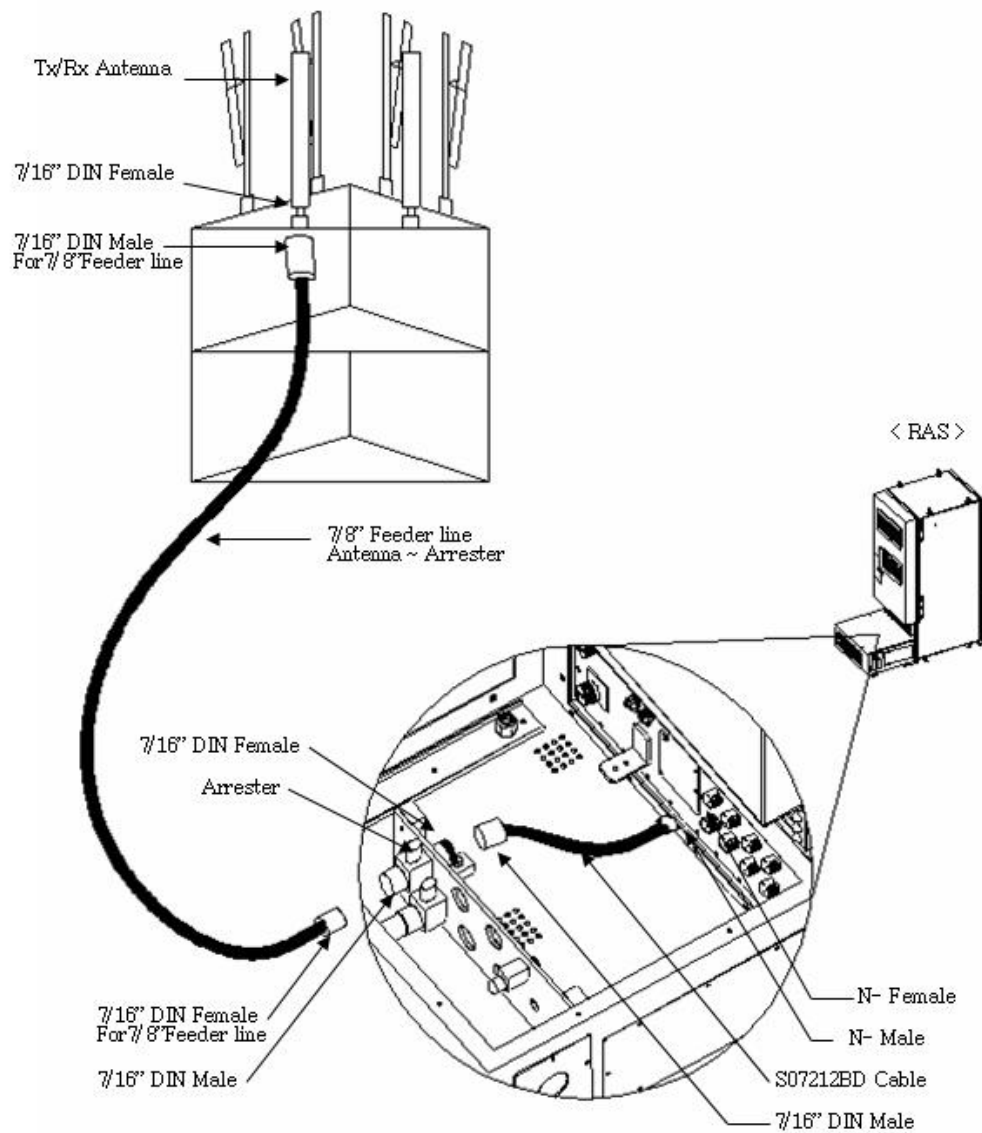
2) RF Cable Deployment

Below [Figure III-9] illustrates overall connection of RF Cable including connectors in all of path.



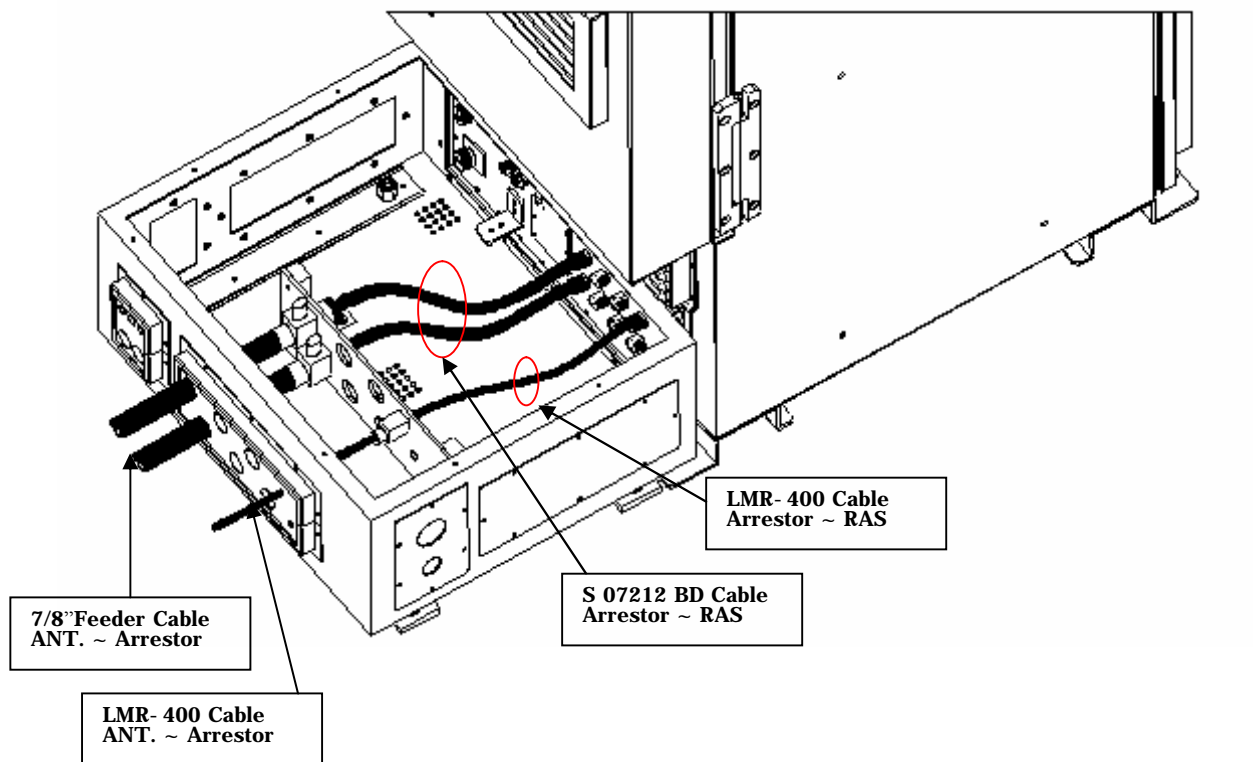
[Figure III-9] RF Cable Connection Drawing

Following illustration shows the actual RF Cable connection mechanism between RAS, Arrestor, and Antenna.



[Figure III-10] Actual RF Cable Connection Drawing

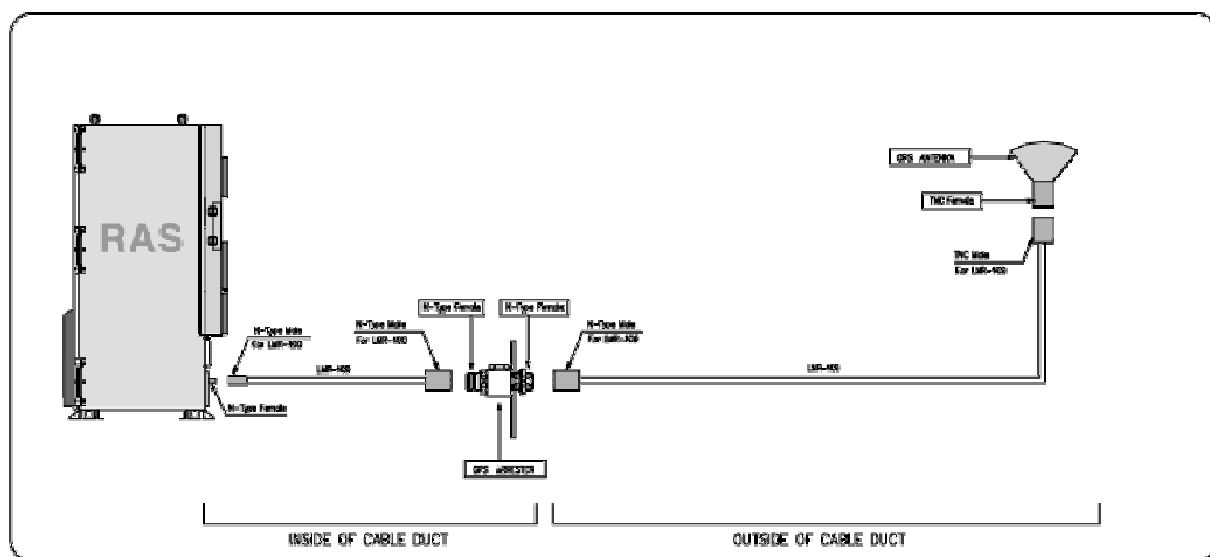
Below illustration shows the RF cable and GPS cable connection from cable duck. It shows RF Cable with connection to Alpha Sector only. Beta and Gamma connection uses same mechanism as Alpha connection.



[Figure III-11] Detailed Connection Drawing of RF Cable

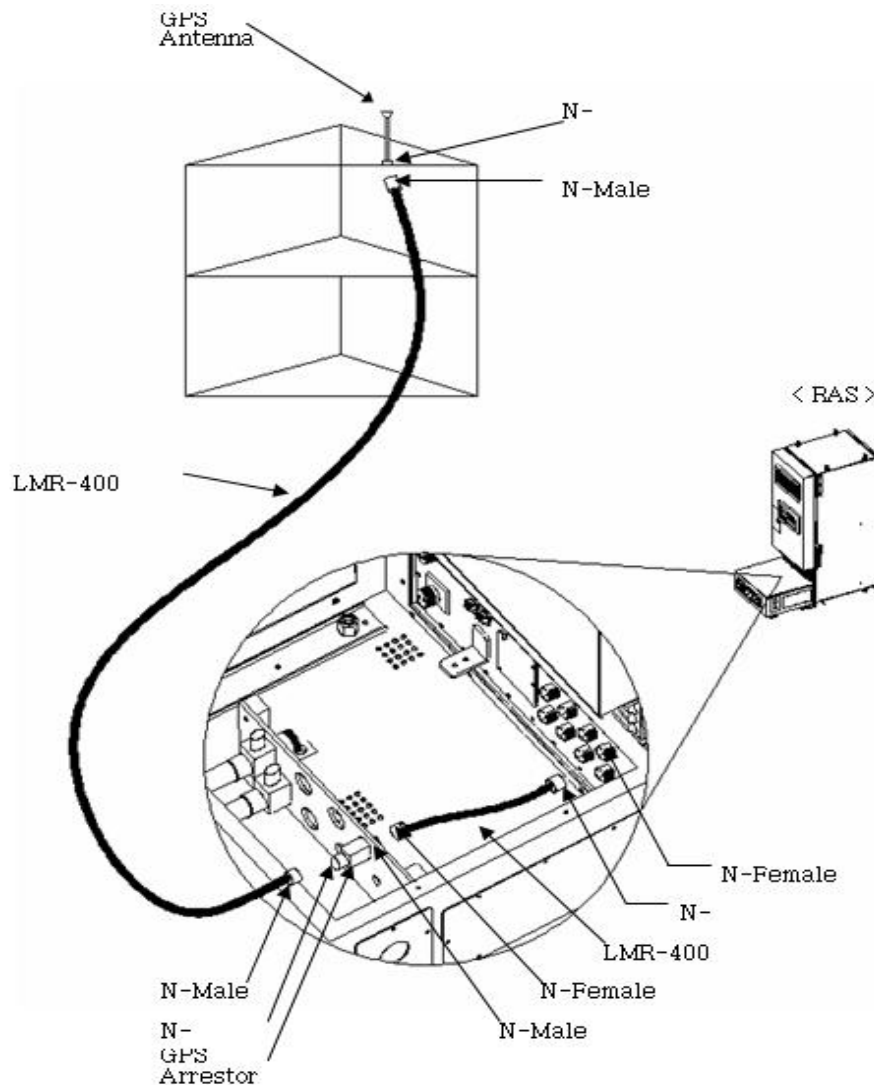
3) GPS Cable Installation

Below drawing illustrates overall connection of GPS Cable including connectors in all of path.



[Figure III-12] GPS Cable Connection Drawing

Next drawing illustrates actual GPS cable connection between RAS, Arrestor, and Antenna.



[Figure III-13] Actual GPS Cable Connection Drawing

RSS Installation

RSS Overall Installation Procedure

1) Site Survey

RSS may be installed using 2 types of installation method; Wall mounting pole and Distributed pole.

During site survey, survey needs to be conducted from the installation perspective.

2) Site Plan

Detailed plan on RSS installation location and definition of cable connections are required.

For cables, detailed plans should be made on connection of feeder cable, ground cable, power cable, and optic cable.

3) Ground Work

Ground work such as installation frame (Wall, Distribute) needs to be prepared for RSS installation.

4) Cable & Rack Installation

Based on the ground work, proceed with Rack installation and cable connection, and complete the installation work.

5) Powering On

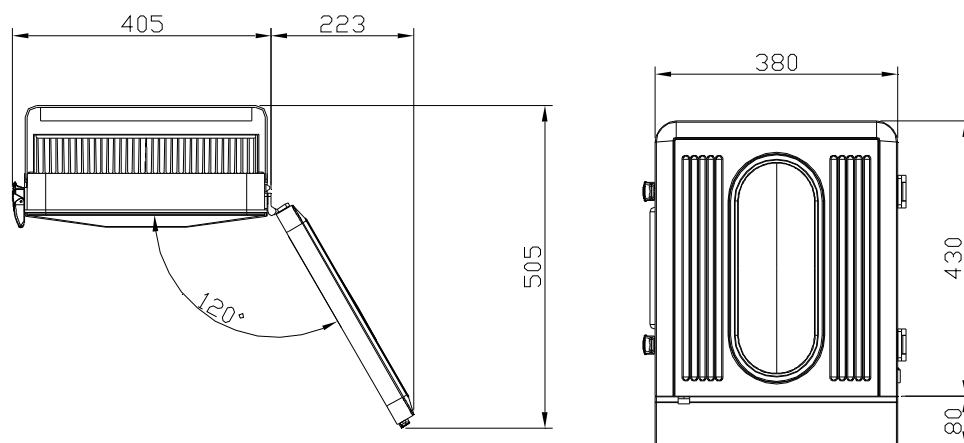
After powering on the system for the first time, turn on all power sources and check the operation status.

6) Checking Installation

After powering on the entire system, check installation details.

Detailed installation procedure

1) Installing RSS fixation frame



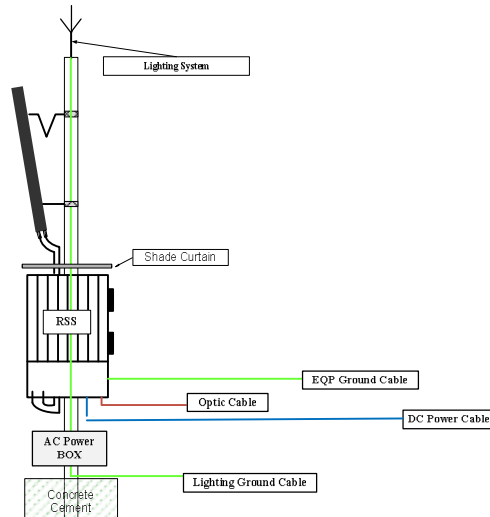
[Figure III-14 RSS Standard Dimension]

When installing RSS fixation frame, appropriate space for the size of RSS needs to be secured as shown in the above illustration.

- Bottom of RSS must be kept approximately 1.5m above the ground.
- For the front area of RSS door, minimum 623mm horizontal space x 505mm vertical space should be secured, taking door opening into consideration.

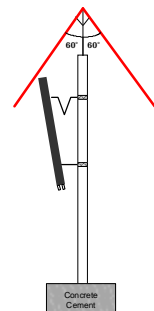
1-2) Installing RSS Fixation Frame

- Distributed Pole Type

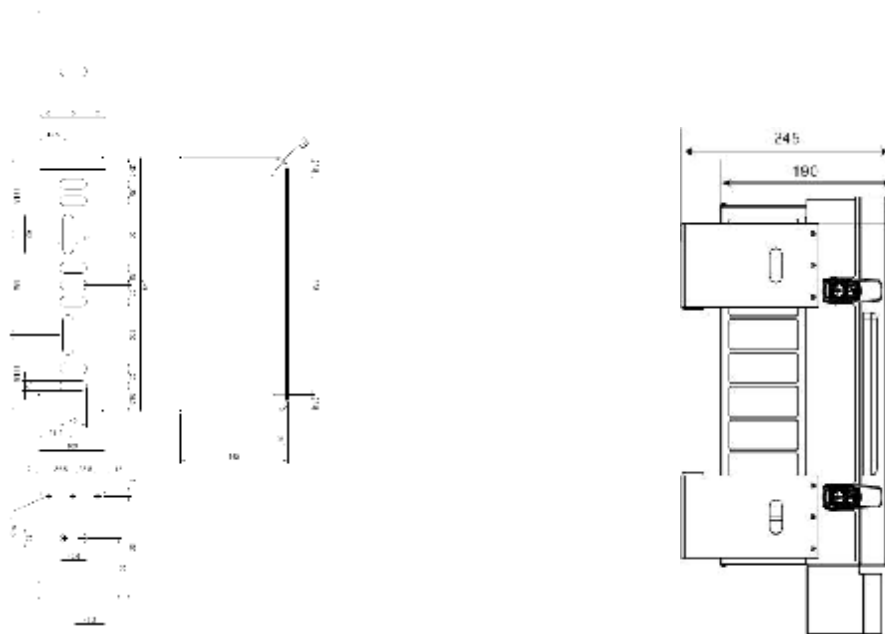


[Figure III-15 Wall mounting Pole Type]

- s Pole supporting concrete block must be safe in size considering wind direction, antenna weight, and RSS weight. Block size should be $60\text{cm}^2 \times 60\text{cm}^2 \times 60\text{cm}^2$ (width x length x height)
 - s Pole thickness should be $\varnothing 60 \sim 80$.
 - s To prevent temperature rise caused by direct sunlight, sun screen needs to be installed at a location 30cm^2 from the top part of RSS.
 - s Lightening rod located at the top of the pole must maintain 60° safety angle.
- As shown in the [figure III-16] it should maintain 60° angle from the top of the service antenna.



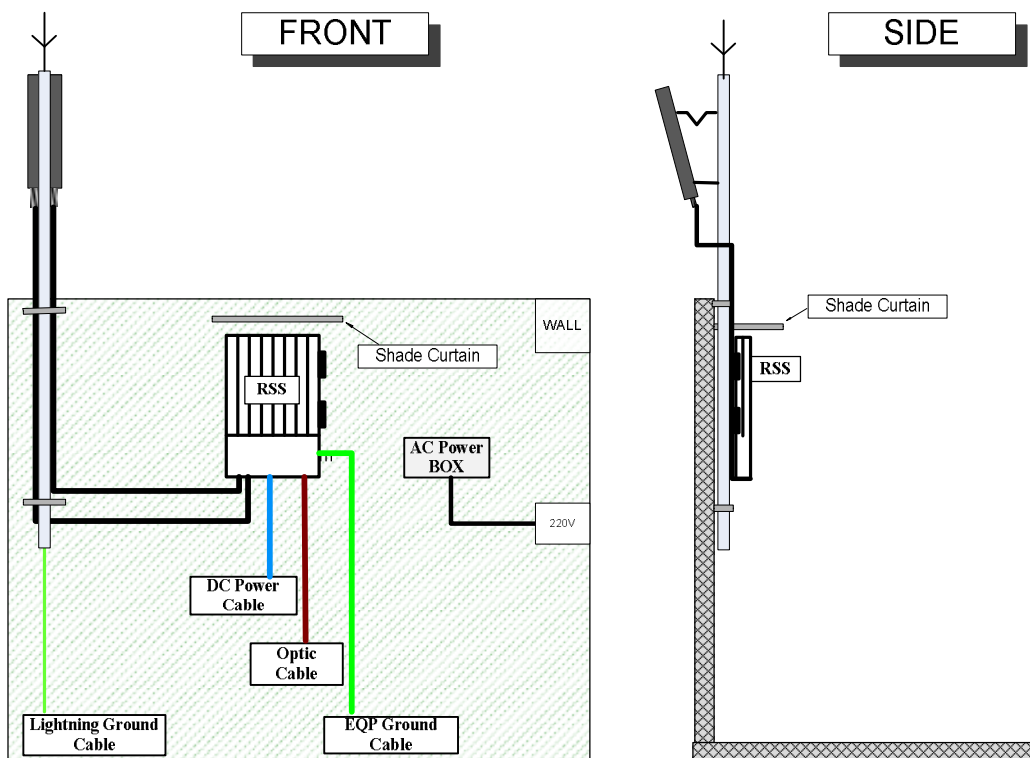
[Figure III-16 Lightning Rod Installation]



[Figure III-17 RSS bracket Size]

s Measuring instrument & distribution panel to install AC service power for general measurement need to be installed.

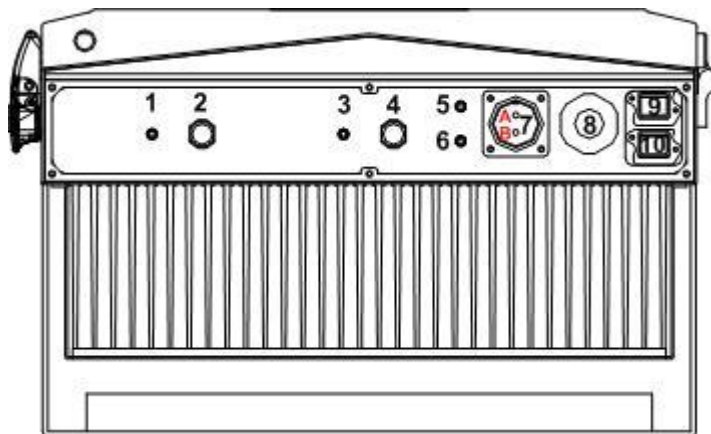
Wall mounting pole Type



[Figure III-18 Wall mounting Pole Type]

- § When mounting on the wall, antenna installation is Ø 60 ~ 80 Pole mount and should be fixed on the wall after installation.
- § Appropriate height of RSS installation is 1.5m above the ground (measuring from the bottom of RSS) considering cable radius of curvature and ease of cable connection and test in the lower part of RSS.
- § Select the most suitable size among the holes in the bracket located in the back of RSS. Fix the anchor nut on the wall and fasten the bolt based on the anchor nut.
- § To prevent temperature rise caused by direct sun light, sun screen needs to be installed at a location 30cm² from the top part of the RSS.

RSS Cable Connection



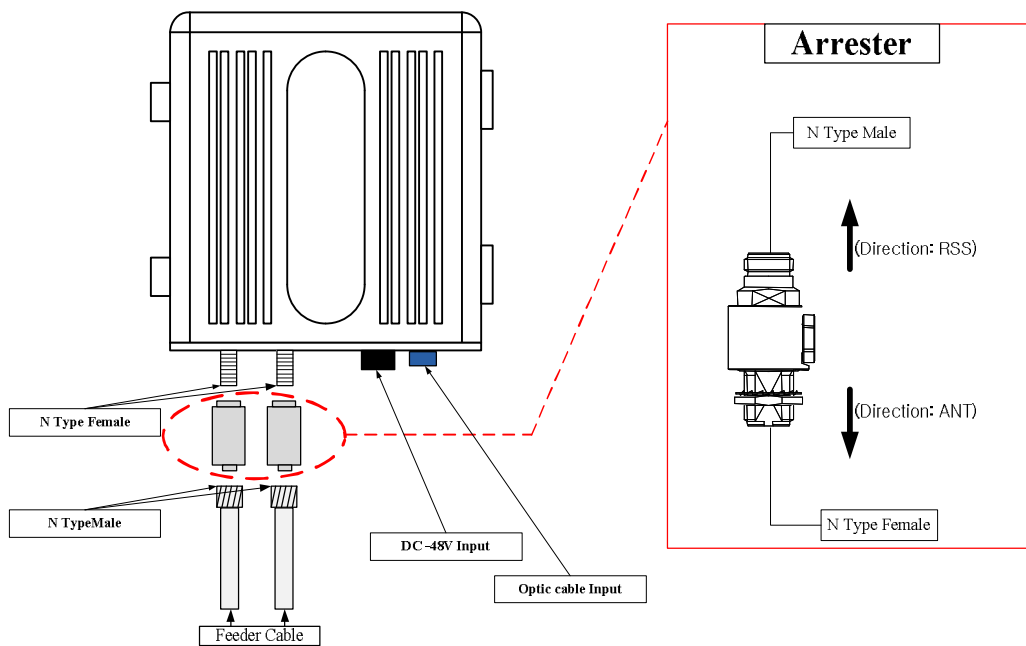
[Figure III-20 RSS Cable Connection]

No	Name	Connector Type	From	Description
1	Tx0 Mon	SMA(F)	Test Port	
2	ANT 0	N(F)	RF_Arrestor_0	
3	Tx1 Mon	SMA(F)	Test Port	
4	ANT1	N(F)	RF_Arrestor_1	
5	TDD	SMA(F)	Test Port	
6	10M	SMA(F)	Test Port	
7	DC -48V	P/N(DDK):D/MS3102A 20-23PRG - Receptacle	Rectifier, P/N(DDK): D/MS3106A 20- 23S(D190)-Straight Plug	A: -48V, B:GND Line Max. AWG10
8	Optic	Combination Coupler	MSS	
9	Debug	RJ-45	Debug Port	Debug Port
10	Alarm_Rec	RJ-45	External Rectifier	Rectifier Alarm

11	SGND	Ground Terminal	Installation Site	AWG10
----	------	-----------------	-------------------	-------

No2. Using No2 port, connect Service Antenna 0 and Arrester, connect the feeder cable as shown in Figure III-21 (Main Antenna Joint Section).

- Connect Arrester N Type Male to No2 Port N Type Female Section.
- Upon completion of Arrester connection, connect Feeder Cable N Type to N Female section located in the lower part of Arrester.
- When all joint parts are connected, process waterproof treatment using insulation tube.



[Figure III-21 RSS Feeder Connection]

No3. If connected identical to No2, feeder cable is connected with Service ANT 1 cable.

- When all joint parts are connected, process waterproof treatment using insulation tube.

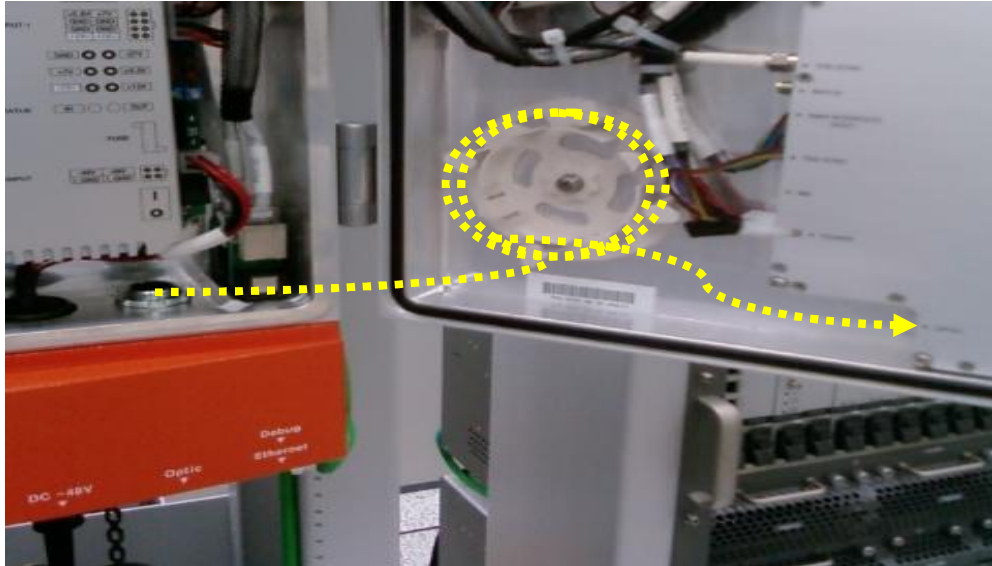
No7. DC -48V Main Power Supply Joint Section

- Connect using Power connector provided through DC -48V service section from Rectifier for RSS (Refer to Figure III-22).



[Figure III-22 Power cable connection]

No8. Insert the Optic cable connecting to MSS into Flexible Hose for Waterproofing, and connect it to the RSS Optic Port.



[Figure III-23 Optic cable connection]

- Reference Figure III-23 and connect Optic cable into RSS interior. Wind up the surplus optic cable and connect it to the input port.
- The standard Optic Cable used is LC Type 2 Core Single mode Optic cable.

No11. Connect RSS Ground Cable.

- After detaching the lug fixed on the lower right part of RSS, connect with 10 Ground cable.
- For the joint between the lug and ground cable, give waterproof treatment using waterproof tube.



[Figure III-24 Ground cable connection drawing]

- When connection between lug port and ground cable is completed, connect to the RSS cabinet exterior using the provided bolts as shown in the figure III-24.

RSS Cable Standard

1) Optic cable

No	Type	Specification Name	Connector	Cable	Remarks
1	Optic Cable	LC-LC-SM-2C	LC Type	Single Mode 2 Core	

2) Power cable

No	Type	Cable Size		Specification Name	Connection	Remarks
		AWG	mm ²			
1	DC Power Cable	10	5.26	UL2464*10*2C	Rectifier ~ RSS	

3) Ground cable

No	Type	Cable Size		Ground Resistance	Grounding Level	Remarks
		AWG	mm ²			
1	MSS EQP	6	13.3	Less than 10Ω	Level 1	
2	RSS EQP	10	5.26	Less than 10Ω	Level 1	
3	Standard Rectifier	6	13.3	Less than 10Ω	Level 1	
4	Small Rectifier	?	?	Less than 10Ω	Level 1	
5	Lighting System	4	21.2	Less than 10Ω	Level 1	
6	Arrester	4	21.2	Less than 10Ω	Level 1	Option

Other cable installation

Rack's internal cables are assembled in the manufacturing process, therefore, separate instructions will not be provided.

When unit mounting is completed, connect the cables to corresponding unit port according to the labels attached at the end of each cable.

Cable Arrangement and Finishing

When cable installation is completed, arrange cables using cable-ties.

Powering On

When installation is completed, turn power on. Powering on process is as follows.

- Make sure power is off on RAS before turn on the switch.

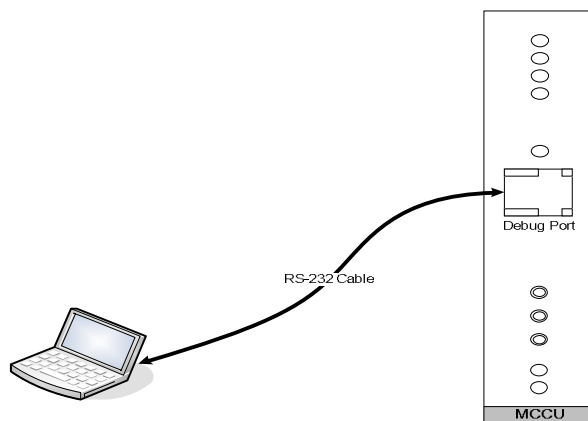
- I After powering on RAS, turn on the switches according to numeric order shown in [Figure III-14].
- I When powering off, turn the switches off in reverse order.

System Check

System Access

Statuses of most units used in RAS system can be check through console connection.

For RAS System Access, serial port of a PC (or Laptop PC) on which communication program (such as Hyper Terminal) is running needs to be connected to console port on RAS equipment unit using the enclosed console cable as shown in [Figure III-15].



[Figure III-15 Console Port Connection]

Following is the program configuration for communication with RAS.

Division	Set Value
Baud Rate	57600 bps
Parity	None
Data Bit	8 Bits
Stop Bit	1 Bit
Flow Control	None

System Check

RAS System mainly operates through interface with other systems such ACR and EMS rather than operating independently. Therefore configuration is required to allow interfaces with other systems.

For details on such configuration and set up, refer to “RAS operations manual” or “RAS CLI Manual” as previously instructed.

Chapter IV. Appendix

Abbreviation and Definitions

- I AAS : Adaptive Antenna System
- I ACR: Access Control Router
- I ADC: Analog to Digital Converter
- I ARQ: Automatic Repeat reQuest
- I CC: Convolutional Code
- I CKDU : Clock Distribution Unit
- I CLI : Command Line Interface
- I CTC : Convolutional Turbo Code
- I DAC : Digital to Analog Converter
- I DCCU: Digital Channel Card Unit
- I DTRP: Digital Transceiver Part
- I DUBB: Digital Shelf Backplane Board
- I FA : Frequency Assignment
- I FACU: Front Access Connector Unit
- I FFT: Fast Fourier Transform
- I FNDU: FAN Digital Part Unit
- I FNRU: FAN RF Part Unit
- I FUSC: Full Usage of Sub-Channel
- I HSDPA/HSUPA : High Speed Downlink/Uplink Packet Access
- I IF : Intermediate Frequency
- I LPM: Line Protection Unit

- I MCCU: Main Control and Clock Unit
- I MIMO : Multi Input Multi Output
- I MRC : Maximum Ratio Combining
- I NISU: Network Interface Switch Unit
- I OFDMA: Orthogonal Frequency Division Multiple Access
- I PDPU: Power Distribution Panel Unit
- I PSS : Portable Subscriber Station
- I PSU : Power Supply Unit
- I PUSC: Partial Usage of Sub-Channel
- I RAS : Radio Access Station
- I RDTU: RAS Diagnostic and Test Unit
- I REMU: RAS Environment Monitoring Unit
- I RFEU: RF Front End Unit
- I RIFU: Repeater Interface Unit
- I RMP: RAS Management Processor
- I RPAU: RAS Power Amplifier Unit
- I RPFU : RAS Power Amplifier Unit & RF Front End Unit
- I RSS: Remote Sub System
- I RSWU: RF Switch Unit
- I RTRP: RF Transceiver Part
- I S-DMB: Satellite DMB (Digital Multimedia Broadcasting)
- I SERDES: Serializer and Deserializer
- I STC: Space Time Coding
- I T-DMB: Terrestrial DMB (Digital Multimedia Broadcasting)
- I TDD: Time Division Duplex
- I TRBB: TRXU Shelf Backplane Board

- I TRXU: Transceiver Unit
- I VoD: Video On Demand
- I WiBro : Wireless Broadband Network, the service name of Mobile WiMAX in Korea
- I WiMAX : Worldwide Interoperability for Microwave Access Forum



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