
3.7M Dual Reflector
RING-FOCUS ANTENNA
SERVICE MANUAL

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Part I. Introduction

1.1 Summary

This manual specifies the assembly and installation of the dual reflector ring focus 3.7-meter antenna system. This 3.7-meter ring-focus antenna is a new-type small aperture antenna for communication station under optimum design. It is applicable to be the antenna of remote station for not only satellite communication but also VSAT networks. This antenna is available for both C-band and Ku-band; furthermore, it can be put into use within various domains like scatter communication, reception of satellite TV, microwave relay communication and so on.

3.7-meter ring-focus antenna adopts new technologies of ring-focus design method and of corrugated feed horn. After being implemented with optimum design, its electrical performances reach the advanced level and overcome the weakness of some traditional design vsat size antenna performance.

Features of the antenna: The main reflecting surface of antenna is composed by twelve pieces of high-precision flabellate surface plates stretched into form with aluminum alloy after quenching. The secondary reflecting surface is fabricated with precision work. Its pedestal is designed into stable and reliable structure of upright column. The antenna system has many unique features such as novel design, high accuracy, excellent appearance, easy installation, simple operation, high mechanical strength, strong wind-resistance and high accuracy on re-installation.

1.2 Main Technical Parameters

1.2.1 Electrical Specification

Electrical Specification	C-Receive	C-Transmit	Ku-Receive	Ku-Transmit
Frequency (GHz)	3.652-4.2 3.4-4.2*	5.85-6.425 5.925-6.725*	12.25-12.75 10.95-12.75*	14-14.5 13.75-14.5*
Gain(dBi)	42	45.2	50.9	52.5
Voltage Standing Wave Ratio	1.25:1	1.25:1	1.25:1	1.25:1
Beamwidth-3dB	1.32°	0.86°	0.47°	0.38°
-15dB	2.75°	1.73°	0.91°	0.75°
Noise Temperature	2-Port Feed		2-Port Feed	
10°E1	36°K		50°K	
20°E1	30°K		44°K	
40°E1	25°K		38°K	
Power Capacity		5KW/port		1KW/port
Interface	CRP-229G	CPR-159G/137G		WR-75
Insertion Loss of Feed	0.15dB	0.2dB	0.25dB	0.25dB
Isolation Tx-Rx		85dB		
Cross Pol Isolation on Axis	35dB	35dB	35dB	35dB
Axial Ratio (circular)	1.09	1.09 1.06(IntelSat)		
Sidelobe Envelope	CCIR-580	CCIR-580	CCIR-580	CCIR-580

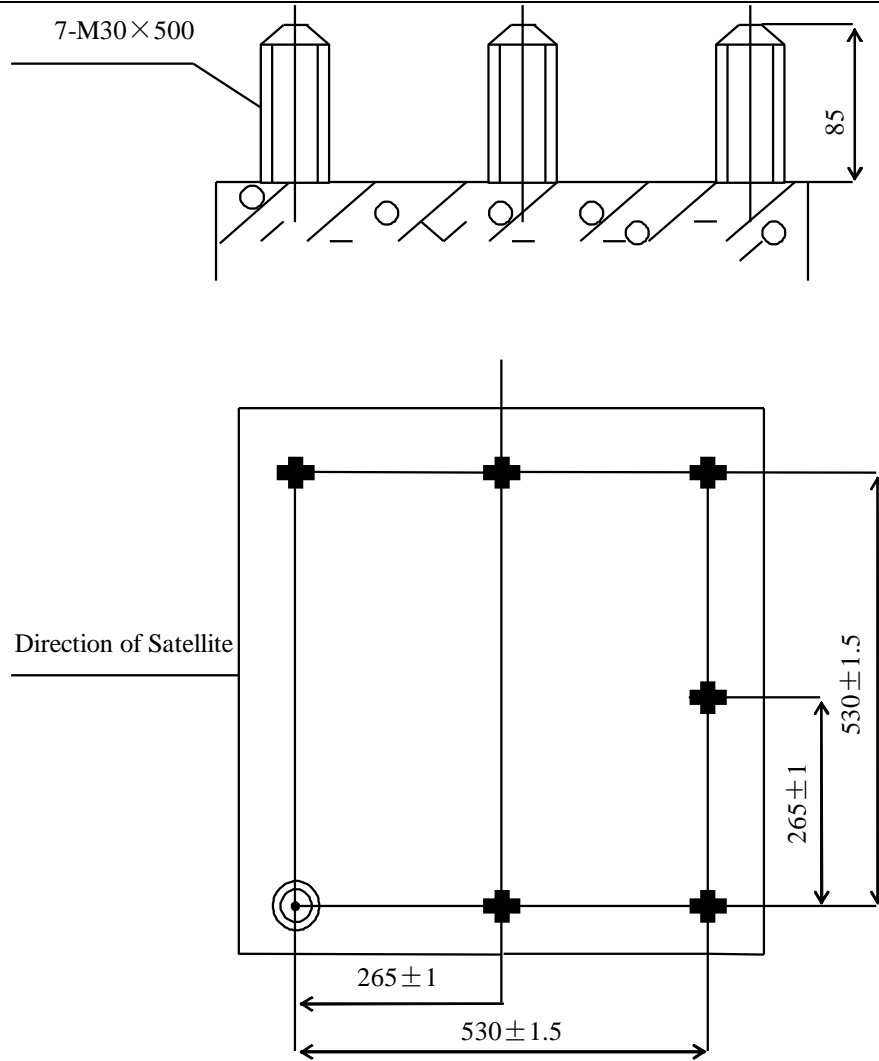
*** feed provided as per customer request**

1.2.2 Mechanical Specification

Mechanical Specification	Parameter
Diameter of Main Reflecting Surface	D=3.7m
Diameter of Secondary Reflecting Surface	d=0.444m
Travel of Azimuth	$\pm 60^\circ$
Travel of Elevation	$5^\circ \sim 90^\circ$
Surface Accuracy	0.5mm (r.m.s)
Re-Installation Accuracy	0.6mm (r.m.s)
Dead Weight of Antenna	600Kg
Spray Paint	White

1.2.3 Environmental Specification

Environmental Specification	Parameter
Operational Wind Speed	72Km/h~97Km/h
Survival Wind Speed	200K/h
Humidity	10%~98%
Temperature	-45℃~+60℃
Anti-Seismic Capacity	Horizontal: 0.3G's Vertical: 0.15G's



Foundation Technical Requirements

1 The level of foundation shall be higher than the ground surface by 200~300mm. The position of anchor bolts shall be arranged for connecting with the reinforcing steel bar in concrete base strictly according to the requirement of the drawing. The foundation shall be formed by processing of casting at one iteration. The anchor bolts shall be kept parallel strictly with each other, and all of them shall be perpendicular with the ground surface. The upper plane of the base shall be flat and level.

2 The dead weight of antenna is 600Kg; its maximal overturning moment is 5500Kg-m (under wind speed of 55m/s).

3 Based on specific status of different installing sites, the foundation shall be designed according to the conditions offered by this figure.

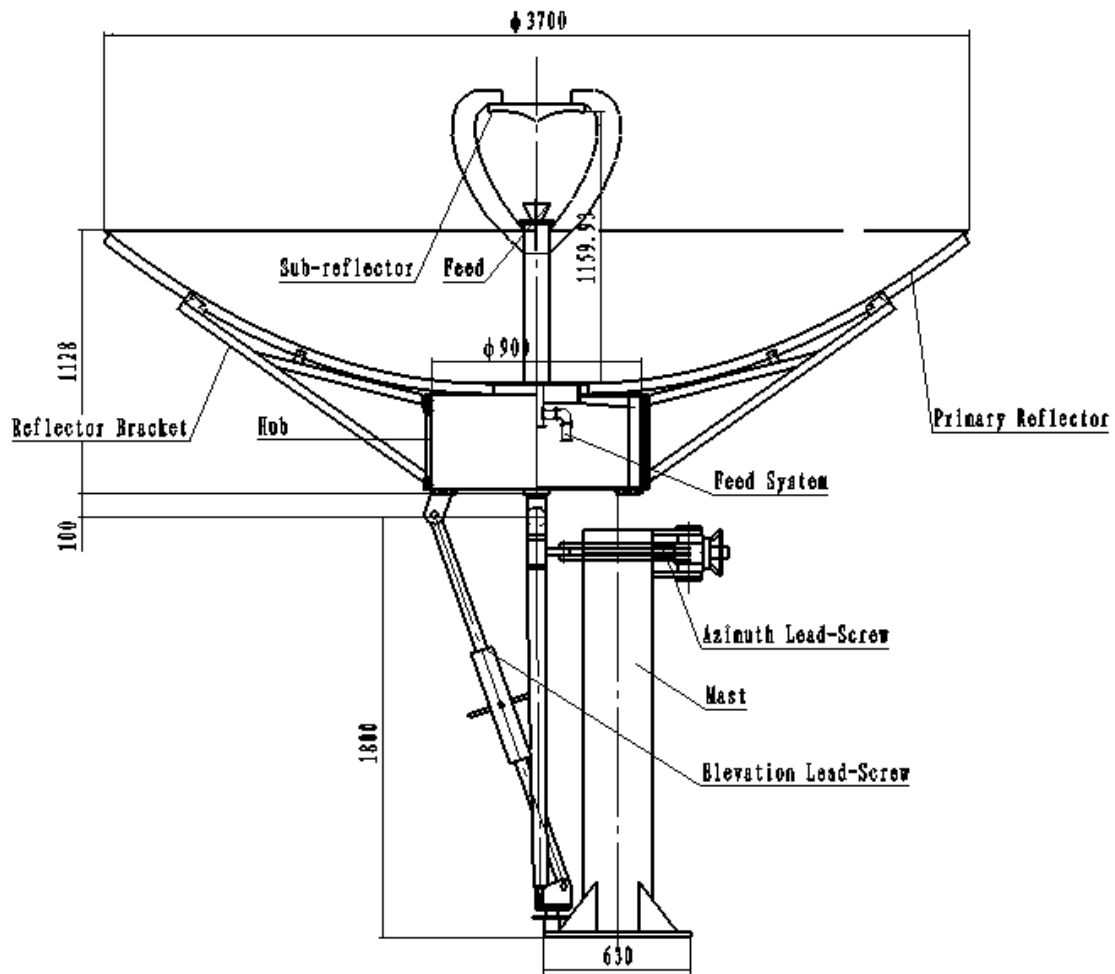


Figure 1. Schematic Figure of Composition of Antenna

1.3 Unpacking Check

Open packing cartons to check all components and parts according to packing list; the components and parts can be assembled and installed only after being made sure that they are complete and undamaged. During installation, the operator shall handle components and parts with care, thus avoid damage to main working surface or lacquer. The installing site shall be kept neat and clean; loss of components or parts shall be avoided.

1.4 Damage during Transportation

Any damage caused during transportation shall be reported to the forwarder of transportation, who will be responsible to your claim on damages of goods.

1.5 Installing Tools (shall be provided by user)

Tools for unpacking					
Wire Cutting Pliers	200mm				1piece
Crowbar					1piece
Iron Hammer	3lbs				1piece
Tools for installation					
Adjustable Spanner	300mm		150mm		2pieces for each type
	450mm				1piece
Double-Head Spanner	19/17		14/12		2pieces for each type
	10/8				4pieces
Screwdriver	Flathead	200×5	Crosshead	200×5	1piece for each type
Tape Measure	5m				1piece
Rubber Mallet	2”				1piece
Iron Hammer	3lbs				1piece
Geologic Compass					1piece
Trestle Ladder	2m				1piece
Wire Cutting Pliers	200mm				1piece

1.6 Foundation Check

Check the layout of anchor bolts on the foundation; the arrow points the approximate direction of satellite.

Part II. Installation of Antenna

2.1 Composition of Antenna, shown in Figure 1.

- 1 Main reflecting surface (12 pieces of plates)
- 2 Reflector Radial/bracket (12 pieces)
- 3 Secondary reflecting surface
- 4 Feed system

5 Feed sleeve

6 Antenna mount

2.2 Base

The design and construction of the base shall be finished before the installation of antenna.

2.3 Installation of Antenna

The installing sequence of antenna: first, installation of pedestal; then, installation of reflectors; finally, installation of accessories.

Note: Installation shall be implemented strictly according to the specified sequence. Any screw bolt should not be fastened/tighten before the sequence requirement allows.

2.3.1 Preparation before Installation

Procedures

1. Open packing cartons to check the amount of components, parts and fasteners.

2. Find concerned serial numbers, lay the components and parts in order, thus to achieve each part matching its installing position. The following components and parts need to be assembled according to serial numbers: connection between reflector brackets and hub, connection between reflectors, connection between secondary surface and feed sleeve.

3. Classification of Fasteners: Screws, nuts and washers shall be classified according to their size and specifications, to facilitate their applications accordingly.

2.3.2 Installation of mount

Procedure 1. Installation of upright column

Fasteners required: Nut M30, flat washer 30 and spring washer 30 - 7

pieces for each type.

Place the upright column gently onto the foundation with care to avoid damaging to screw threads of anchor bolts. When the undersurface of the column fully clings to the foundation, operator shall utilize compass to check if the upright column is perpendicular to ground surface. After making sure the perpendicularity, operator shall fasten all nuts. (shown in Figure 3.)

Procedure 2. Installation of rotary pedestal

Fasteners required: Screw bolt $M16 \times 35$, flat washer 16 and spring washer 16 - 4 pieces for each type.

Install the rotary pedestal on the flange located under the upright column, then mount screw bolt $M16 \times 35$ (4 pieces). At first, please do not fasten these bolts; they shall be fastened only after the next procedure is fulfilled, in which the supporting frame can rotate agilely. (shown in Figure 4.)

In some circumstances the rotary pedestal of antenna has been assembled before delivery, for which the operator can implement following procedures:

Procedure 3. Installation of supporting frame

Purchasing parts required: Cotter pin $\Phi 5 \times 50$ - 1 piece

Lubricate the ball socket of rotary pedestal, mount the lower button head of supporting frame into the ball socket of rotary pedestal, then insert the single lug into the position between the double lug located above the upright column; then according to the size of clearance between lugs, insert washers of 5mm and 0.5mm into the clearance; after minimizing the clearance in position A, insert the pin 1# through it, and then mount the cotter pin. Rotate the supporting frame around the rotary pedestal; if the

rotation of supporting frame is found with occurrence of detention, the operator can knock the rotary pedestal for making the supporting frame rotates agilely; then fasten all screw bolts $M16 \times 35$ on the rotary pedestal. (shown in Figure 5.)

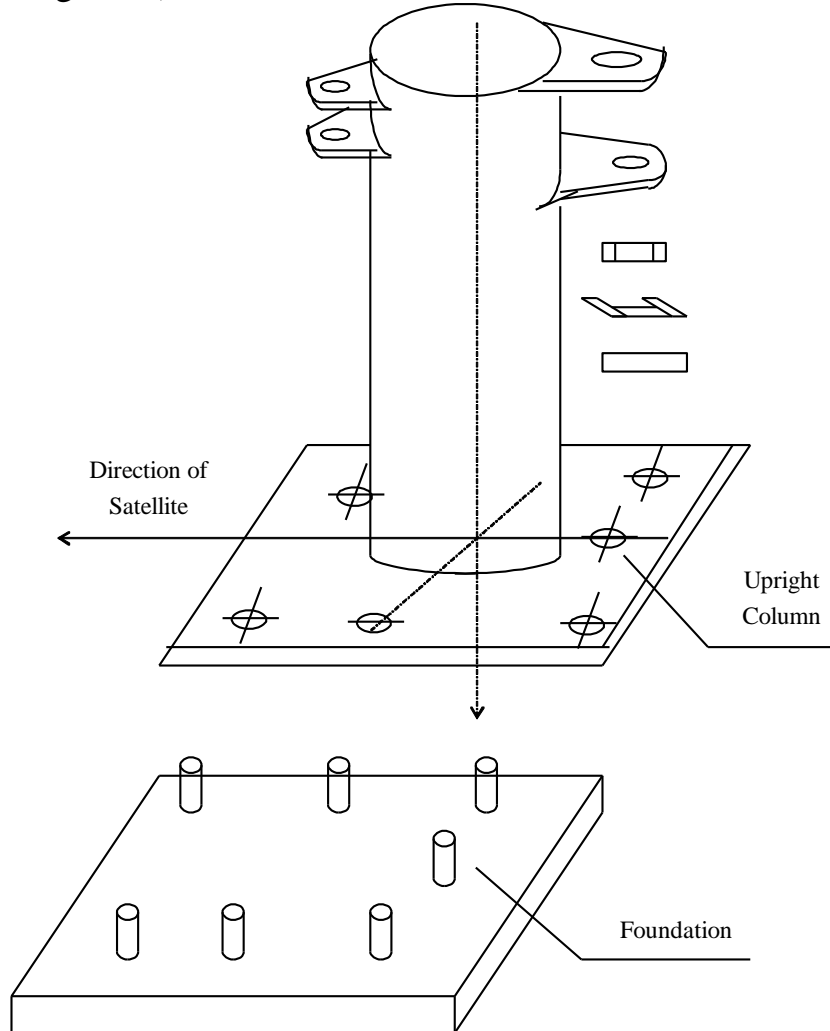


Figure 3. Installation of Upright Column

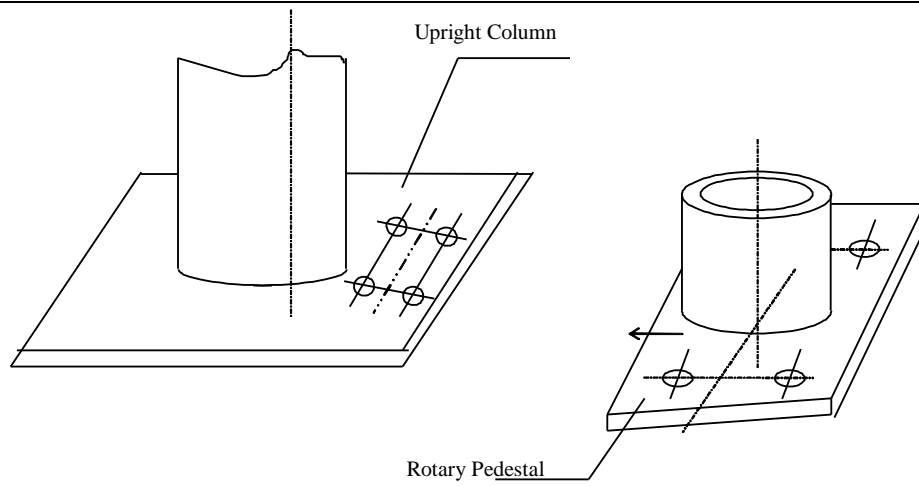


Figure 4. Installation of Rotary Pedestal

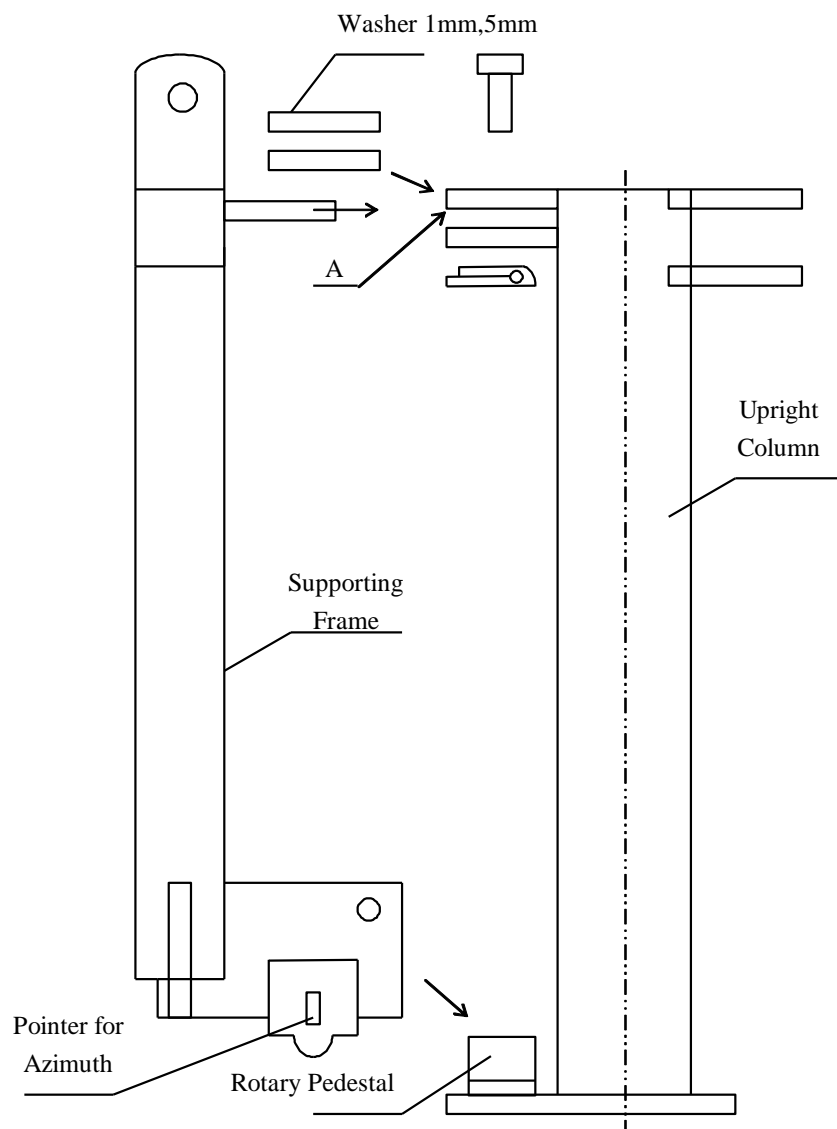


Figure 5. Installation of Supporting Frame

Procedure 4. Installation of azimuth adjusting device

Fasteners required: Screw $M16 \times 20$, 8 pieces; cotter pin $\phi 5 \times 50$, 1 piece.

Put one end of azimuth device into the position between the double lug located above the upright column, mount two short flange axes, then fasten the screws. Rotate the supporting frame, insert the lug of lead screw for azimuth into the position between the double lugs of supporting frame, mount the pin 2#, and then mount the cotter pin. (shown in Figure 6.)

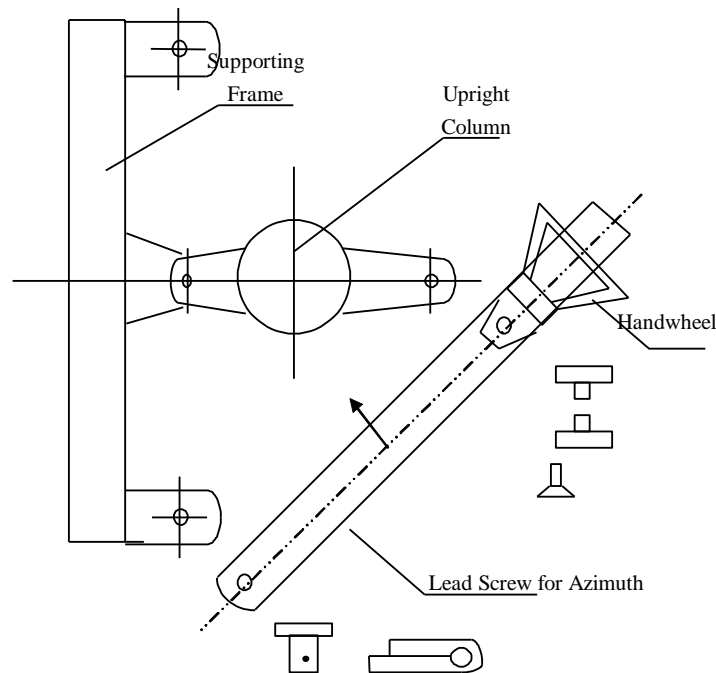


Figure 6. Installation of Device of Azimuth

Procedure 5. Installation of adjusting device of elevation

Purchasing parts required: Cotter pin $\phi 5 \times 50$, 1 piece.

Insert one end of lead screw for elevation into the position between two plates located at the lower part of supporting frame, mount the locking shaft 2#, and then mount the cotter pin. Screw out the other end of lead

screw for elevation until its erected height is approximately equal to the height of double lugs on the supporting frame, then place the lead screw for elevation into proper position, thus to make preparation for next procedure, the installation of hub. (shown in Figure 7.)

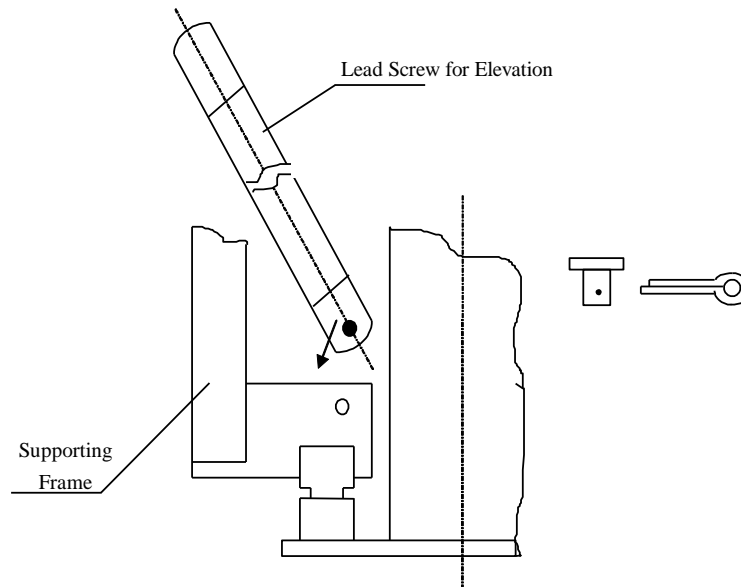


Figure 7. Installation of Device of Elevation

2.3.3 Installation of Reflector of Antenna

Procedure 1. Installation of central unit/Hub

Fasteners required: Screw bolt M16×60, nut M16, flat washer 16, spring washer 16; 12 pieces for each type. Cotter Pin $\phi 5 \times 50$, 3 pieces.

At first, clean the screw holes and pin holes of three lugs, then lubricate them with grease. Mount these lugs onto the lead screw for elevation of supporting frame; mount the pin 2#, then mount the cotter pin.

The operator(s) lift the central unit horizontally, and then place it above the pedestal. After aligning the upper hole of central unit with the upper hole of lug on supporting frame, insert 8 pieces of screw bolts, mount nuts, flat washers and spring washers respectively, and then fasten them.

Lift the lead screw for elevation; align the four holes of lugs on its upper part with the four holes of central unit. Insert 4 pieces of screw bolts;

mount nuts, flat washers and spring washers respectively, then fasten them. (shown in Figure 8.)

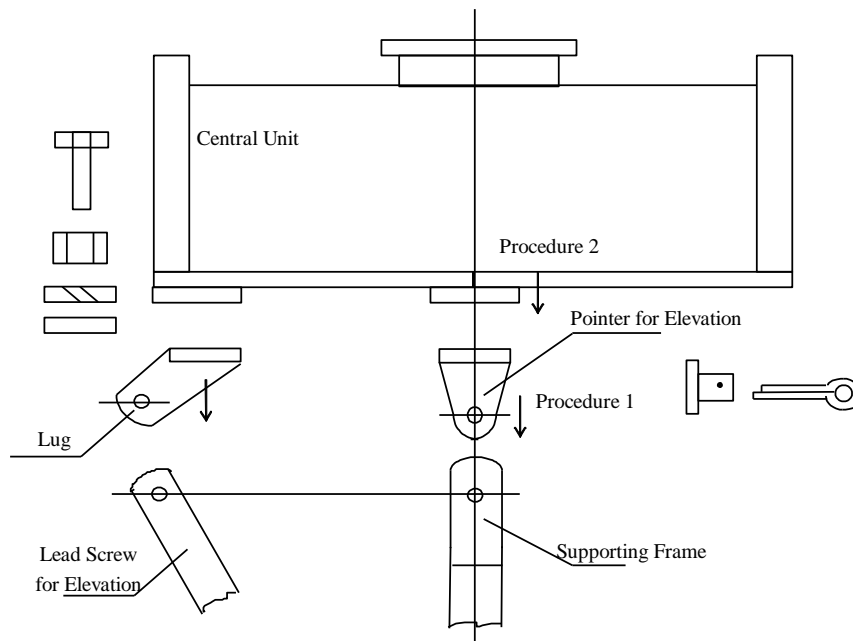


Figure 8. Installation of Central Unit

Procedure 2. Installation of reflector bracket/Radial

Fasteners required: Screw bolt $M16 \times 40$, nut $M10$, flat washer 10, spring washer 10 - 36 pieces for each type.

Check the mark on reflector bracket, such as 5-1, 5-2, ..., 5-12. Corresponding with the marks on central unit, legs shall be mounted onto left side of side plate on central unit. Align the upper hole on reflector bracket with the pin on the side plate of central unit (on the central unit, position marked with \times is pin, position marked with $—$ is hole.), and mount the leg. Then insert bolts into the other three holes; mount nuts, flat washers and spring washers respectively, then fasten them. (shown in Figure 9.)

Procedure 3. Installation of reflectors

Fasteners required: Screw $M5 \times 12$, 24 pieces; screw bolt $M8 \times 30$ (with pin), 24 pieces; screw bolt $M8 \times 30$, 24 pieces; nut $M8$, 48 pieces; flat washer 8, 48 pieces.

Check and make sure that the marks on narrow edge of reflector are corresponding with the marks on central unit, and then stand-by for installation.

Turn the narrow edge of reflector toward the central unit; then from outside to the direction of central unit, insert the plate to the position of flange on the central unit. From above to below, fall the surface plate into the position between the reinforced beam for upper surface plate of central unit and the left side of reflector bracket; then fasten the two screws $M5 \times 12$ located at the joint between narrow edge of reflector with the flange on the central unit.

Adopting the same method, mount abutting reflector and fasten the two screws $M5 \times 12$. Note: the reinforced beam of surface plate shall be installed onto the right side of plate of supporting leg.

Mount two screw bolts $M8 \times 30$ (with pin) onto two pieces of reflectors and supporting leg; at the position B, mount two screw bolts $M8 \times 30$; then mount nuts, flat washers and spring washers respectively, but these parts shall not be fastened for the moment.

Adopting same method, mount all surface plates. During installation, all parts shall be handled with care. When fastening the screw $M5 \times 12$, the operator works inside the central unit, which requires the operator shall wear soft-sole shoes.

After all reflectors are mounted, fasten all fasteners in the order from inner cycle to outer cycle. (shown in Figure 9.)

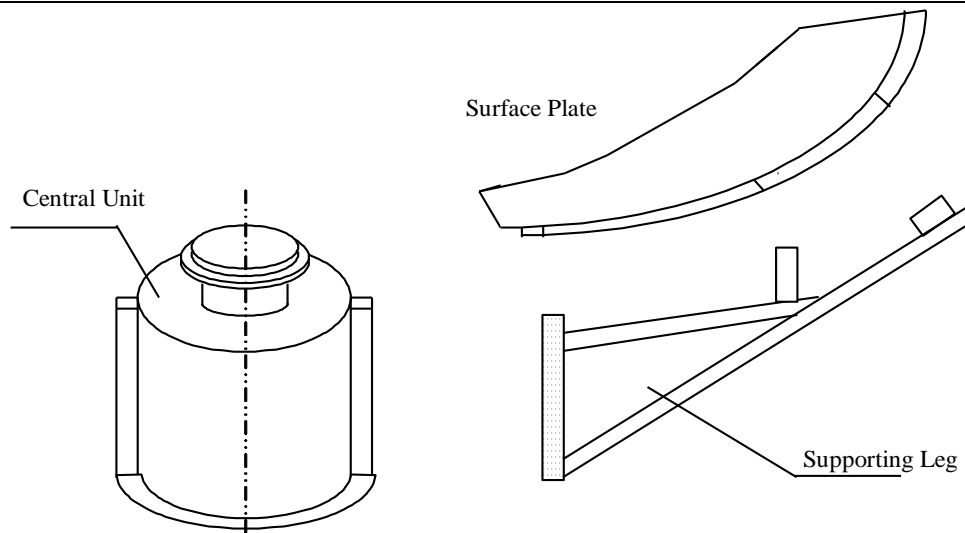


Figure 9. Installation of Supporting Legs and reflectors

2.3.4 Installation of Feed and Sleeve of Feed

Fasteners required: Screw bolt $M8 \times 10$, 4 pieces; screw bolt $M8 \times 16$, 8 pieces; screw bolt $M6 \times 20$, 8 pieces; screw bolt $M4 \times 25$, 48 pieces (supplied within the box of feed); flat washer 8, 12 pieces.

Check to make sure there is no dirt and paint found at the rabbet between hole of central unit and sleeve of feed, or at the rabbet between upper hole of feed sleeve and horn. Clean these parts and lubricate their matching surfaces with grease.

At first, on the ground surface of operating site, mount the feed (consists of horn, wave-guide and phase shifter, which shall be mounted with rubber ring) into proper status, then fasten screws (feed and screws are all packed in the box of feed). After connecting, the overall length of feed shall be longer than the height of feed sleeve. Install mounted feed into the sleeve of feed, then fasten screw bolts $M6 \times 20$. Install the clunk at the bottom of feed sleeve, then fasten 4 screw bolts $M8 \times 10$. (shown in Figure. 10)

Take mounted feed and the sleeve of feed into the reflecting surface of

antenna, mount them onto the hub with care for avoiding damage to the phase shifter exposing outside the sleeve of feed, then fasten screw bolts $M8 \times 16$, (shown in Figure 11.)

Inside the central unit, mount the duplexer from the direction of bottom according to indication of figure (duplexer and screws are all packed in the box of feed), (shown in Figure 12.)

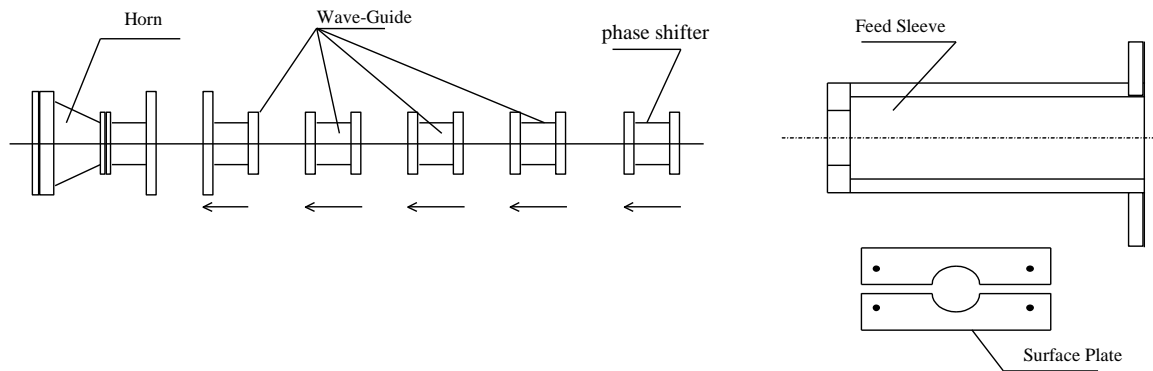


Figure 10. Installation of Feed

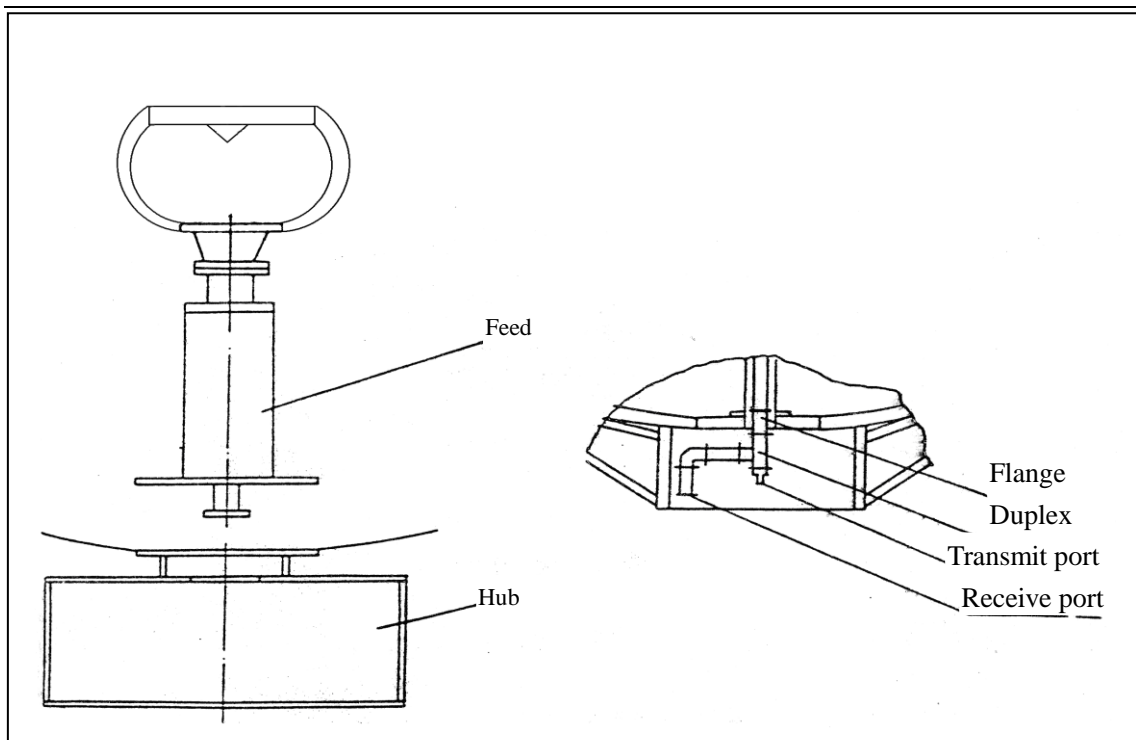


Figure 11. Installation of Feed Sleeve

Figure 12. Installation of Duplexer

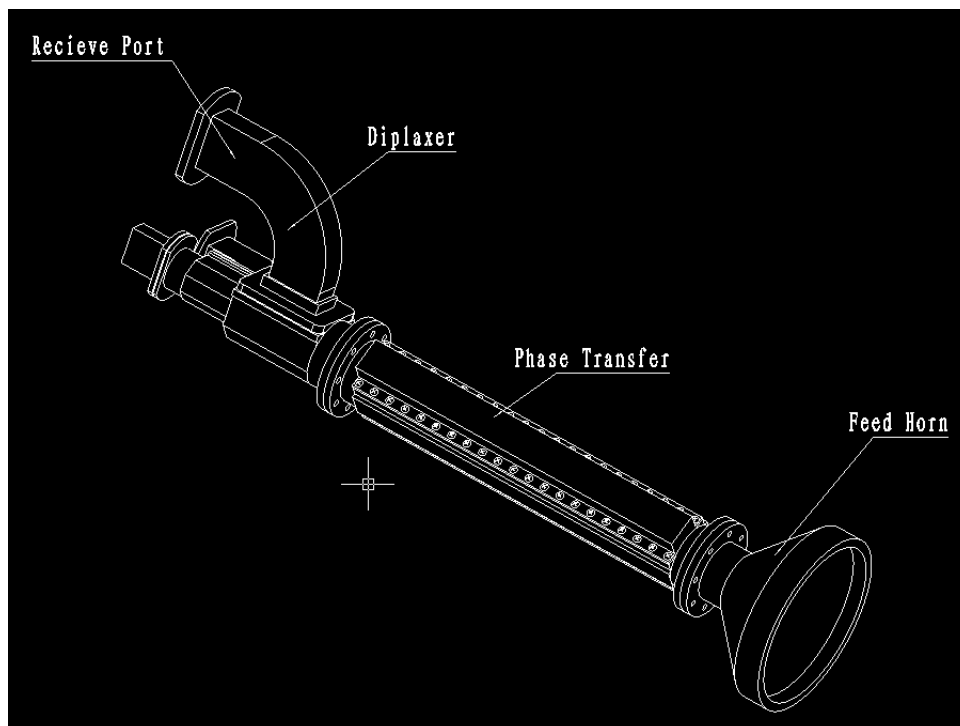


Fig. 13 Feed source system installation

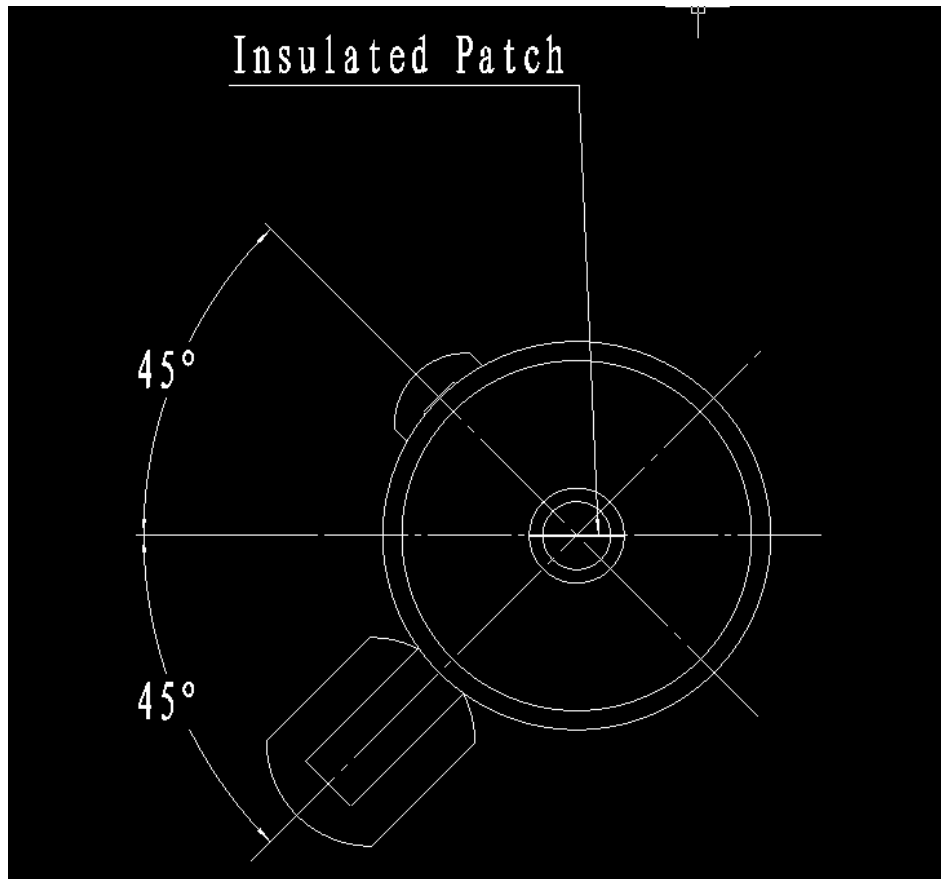


Fig. 14 Feed source system installation

Device of Polarization Rotation

Polarization adjusting mode is manual. The polarization adjusting device consists of rotating flange, upper and lower level of rolling track, which is shown in Fig.

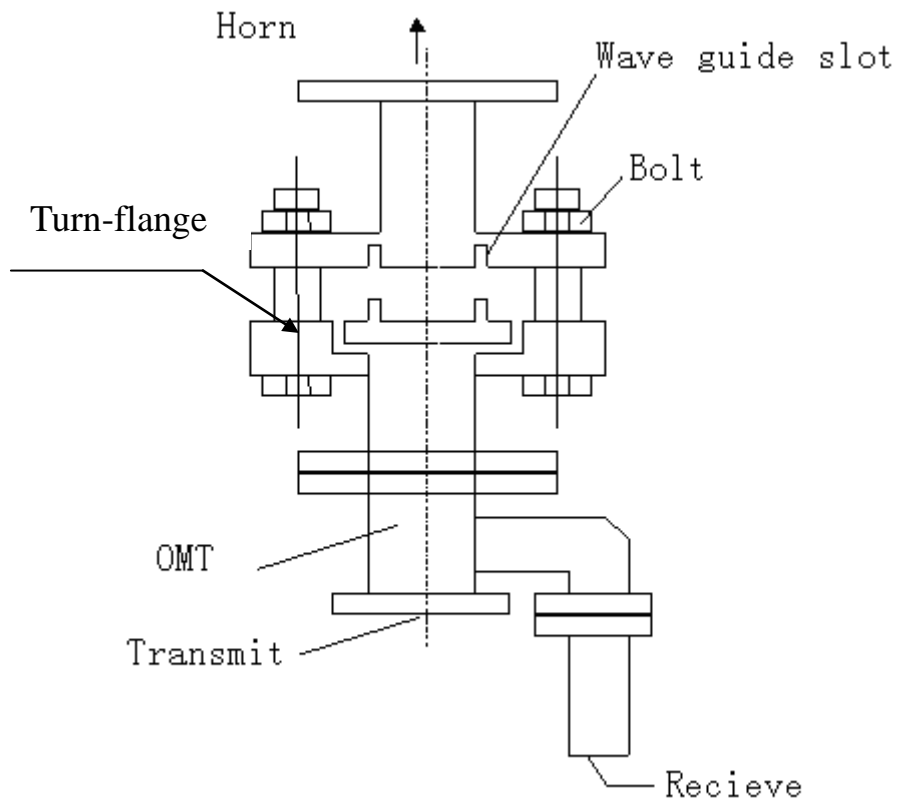


Fig 15. Device of Polarization Rotation

Drawing of phase shifter and duplexer contact(For circular system)

(View from rectangle waveguide to feed)

Receive R-Circular Polarization, Transmit L-Circular Polarization

45°

CPR-229G

Screw contact palne

CPR-159G/137G

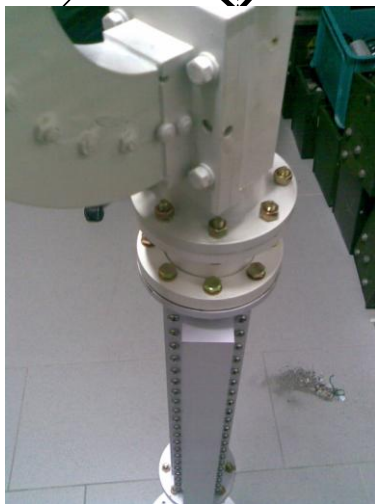
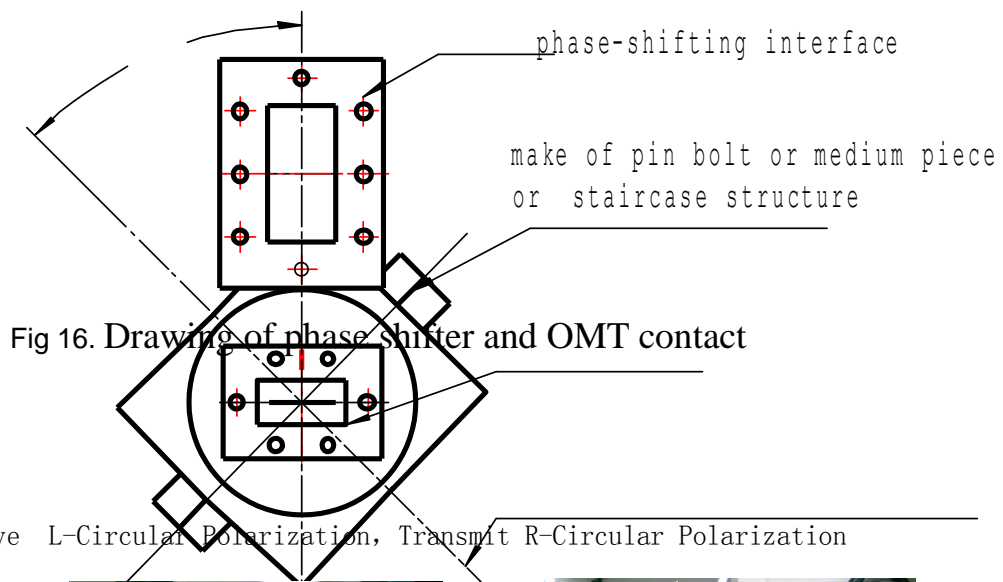


Fig 17. Photos of medium phase shifter and OMT contact

Receive R-Circular Polarization, Transmit L-Circular Polarization



Fig 18. Photos of wave-guide phase shifter and OMT contact

2.3.5 Installation of Secondary Reflector

The subreflector is modulized into the feed and pre-installed in the factory.

Part III Operation of Antenna's Alignment to Satellite

3.1 Azimuth Adjustment of Antenna (shown in Figure 5.)

The azimuth adjustment shall be implemented by turning the hand wheel on the axis of azimuth. The operation shall be implemented slowly.

3.2 Elevation Adjustment of Antenna (shown in Figure 6.)

The elevation adjustment shall be implemented by turning the handle on the axis of elevation. Note: when the antenna is turned to the position nearly skywards, the turning of handle shall be operated slowly; operator must pay attention to avoid turning the lead screw for elevation out.

3.3 Determination on Azimuth Angle, Elevation Angle and Polarization Angle

Elevation Angle of Antenna

$$E = \arctg\left(\frac{\cos\theta \times \cos(\phi_s - \phi_o) - R/(R+H)}{\sqrt{1 - (\cos\theta \times \cos(\phi_s - \phi_o))}}\right)$$

Azimuth Angle of Antenna

$$A = 180^\circ + \arctg\left(\frac{\tg(\phi_s - \phi_o)}{\sin\theta}\right)$$

Polarization Angle of Antenna

$$P = \pm\{90^\circ - \arctg\left[\frac{\tg\theta}{\sin(\phi_s - \phi_o)}\right]\}$$

When $\phi_s - \phi_o > 0$, P will be —

When $\phi_s - \phi_o < 0$, P will be +

In these formulas:

R—radius of earth: 6370Km

H—height of satellite: 35786Km

ϕ_s —geographical longitude of satellite station (east longitude)

θ —geographical latitude of satellite station (north latitude)

ϕ_o —longitude of subsatellite point of aligned satellite (east longitude)

Part IV Maintenance and Service of the Antenna

4.1 The matching parts for rotation and fastener shall be checked for rusting. If the rust spot is found, the part shall be cleaned on time and lubricated with grease. The driving lead screw can be installed only after the matching surface between supporting bar and upright column is lubricated with grease.

4.2 When it requires operator should mount onto the main reflecting surface of antenna, only 1 to 2 persons in lighter weight can be allowed to mount onto it, and the operator shall wear soft-sole shoes for avoiding deformation and damage of reflecting surface.

4.3 Once the diaphragm on horn of feed is found with broken, the diaphragm shall be replaced immediately.

4.4 Any water is prohibited to be entered into the feed system. Water influent will influence the performance of antenna seriously, even cut off the communication, which shall be attached most importance to.

4.5 The antenna works in open air, so the operation of antirust shall be implemented at any moment. The shed surface paint shall be repaired in time; the moving components and parts shall be cleaned and lubricated with grease regularly. The fastener shall be checked termly for avoiding loosening; especially after strong gale, all loosened fasteners shall be fastened in time.

4.6 Any person not concerned with operation is prohibited to stay in the operating site of antenna.

4.7 The snow on the antenna shall be removed in time.

4.8 After two years of application, the antenna shall be re-sprayed with white paint of alkyd enamel.

4.9 The device of lightning protection shall be installed.

Part V Troubleshooting

If the signal received or transmitted by antenna is weakened, operator can check following parts and implement the repair:

5.1 Check if the alignment to satellite is accurate, and then implement fine adjustment to azimuth or elevation.

5.2 Check if the diaphragm on horn of feed is broken; the damaged diaphragm shall be replaced immediately.