

**PRASAR BHARATI
BROADCASTING CORPORATION OF INDIA
DIRECTORATE GENERAL:ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)**

F.No. 27/12/ Spec./DEs Comm -I/2006D(TD/FM)&
FNo: 27/12/2(4 bay)/2005-D(TD/FM)

**SPECIFICATION FOR 4 BAY CIRCULARY POLARIZED VHF FM
ANTENNA FOR AIR FM PROJECTS**

**(With Ice loading]) (For antenna to be mounted on the leg of TV tower at
Srinagar TV Site)**

Specification No.: **Specification No: Xth plan/4 BAY VHF ANTENNA /FM /1/October -
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The Committee of Directors Engineering has approved the above Specification after discussions held in the meeting on 11.7.2006. After the DEs Committee the above Specification has been approved by CE (Project), DG:AIR on file.

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N.B. : 1. Each clause of this specification has to be complied with & supported by printed matter from the manufacturer of the equipment by the Tenderer, without which tender will be considered incomplete and failing which the tender shall be liable to be rejected .The Tenderer

should make a detailed offer while quoting for the 4 bay VHF FM Circularly Polarized antenna.

2. All the 4 bay VHF FM Circularly Polarized antenna data, technical details, Schematic drawings and schedule of requirement/material must be submitted and enclosed with the tender by the tenderer and failing which the tender shall be liable to be rejected .
3. Tenderer shall quote the rate / cost of individual spares in the tender offer while submitting the offer for spares.
4. This Specification comprises of 16 pages.
5. The Tenderer shall submit schedule of material/requirement of Supply without price as above in Section-I, II ,Annexure I,II,III to Section 2.0 of AIR Specification (two bid system i.e. technical bid and commercial bid).
6. The tenderer shall submit the tender offer to AIR in the format given below .

Sr No. of AIR Spec. Section wise& Clause wise	Details of AIR Spec.	Performance figures of equipment, schematic drawing Nos. and Model No.	Compliance Yes/NO	Deviations in case of non-compliance	Ref to tender page No.	Remarks
Section -I						
Section -II						
Annexure-I						
Annexure-II						
Annexure-III						

7. The tenderers shall fill up their name in CAPITAL LETTERS, full address with pin code , phone number, fax number, e-mail address and with their full signatures before the submission of their tender offer to AIR.

SECTION - I

GENERAL SPECIFICATION:

1.0 Please refer tender documents for general term and conditions of contract for supply including all the commercial aspects like ; Packing and Packing List, Insurance and Marine Risk etc., Guarantee, Payment terms, Penalty/Compensation for Delay, Damages and Liabilities, Time Period and Extension for Delay , Foreclosure of Contract due to Abandonment or Reduction in Scope of Supply , Cancellation of Contract in Full or Part, Recovery of Security Deposit, Performance Guarantee, Unsatisfactory Workmanship, Damages Incurred During transit, Tenderer Liable for Damages, Defects, Recovery of Compensation, Ensuring Payment and Amenities, Tenderer to Indemnify Government against Patent Rights, Release of Security Deposit, Safety Code ,insurance from manufacturer's works/factory to respective site etc i.e. in totality

2.0 INSPECTION: 4 bay VHF FM Circularly polarized antenna will be accepted on the basis of manufacture's test Certificates as per Standard International manufacture's practice and receipt of material as per Supply Order.

3.0 DETAILS REQUIRED ALONG WITH TENDER (4 BAY CIRCULARLY POLARIZED VHF FM ANTENNA SPECIFICATION (PRESSURIZED):

- 3.1 Complete technical information, details, parameters and drawings as mentioned in **Section -II (technical specifications)** as above are to be submitted with tender *by the tenderers*.
- 3.2 Complete set of *Technical* drawings / Engineering drawings giving full details and dimensions of dipoles / Bays and rigid lines etc. with complete list of items to be submitted with tender.
- 3.3. Make, model and type of rigid lines, interconnecting RF co-axial air dielectric cables, end connectors etc are to be given in tender along with their power (continuous average) handling capacity. Details of rigid lines assembly, components used and engineering drawings are to be given.
- 3.4 A write up giving full working details and salient *technical* features of the antenna system are to be submitted with tender by the tenderers.

A copy of printed tech. manuals, including specifications of antenna and installation / operation instructions are to be forwarded with tender. Technical details relating to pressurization are to be submitted with tender *by the tenderers* for the complete system as per para 1.0 and 1.2 of Section -II(technical specifications)

- 3.5 A list of required spares and installation accessories/tools etc. along-with item-wise price details are to be quoted separately(as option) with tender by the tenderers.
- 3.6 Para-wise & item-wise compliance statement should be forwarded with tender. Actual value *shall* be indicated wherever possible and deviations may be clearly stated. All information and details asked for must be forwarded with tender.
- 3.7 In support of Tenderer's claim an "up-to-date" list of their customers alongwith complete set of actual performance figures i.e. Performance measurement taken on the 4 bay VHF FM circularly polarized antenna (pressurized) (duly certified by the customers) must be furnished along with the tender.

4 bay VHF FM circularly polarized antenna (pressurized) shall be field proven for satisfactory operation. A supply record of 4 bay VHF FM circularly polarized antenna (pressurized)power wise and year wise in the last 5 years may be enclosed by the tenderer.

Names, Address and Fax numbers of customers must be indicated.

4.0 GENERAL:

4.1 INFORMATION TO BE SUPPLIED BY THE TENDERER AFTER AWARD OF SUPPLY ORDER :

One **printed & duly bound** set of Installation, Commissioning, Operation & Maintenance manuals for complete 4 bay VHF FM circularly polarized antenna (pressurized) shall be supplied to the Director Engineering (Project), P&D Unit DG AIR New Delhi within one month of Acceptance of Tender.

All the details should be complete and exhaustive. One Soft copy of these documents is also required on CD for use with PC.

4.2 INFORMATION TO PRECEDE DESPATCH OF EQUIPMENT:

Following information should be supplied to the DE (Proj) P&D Unit DG AIR New Delhi, and each of the consignee, one months prior to dispatch of Equipment:

- 4.2.1 Detailed list of Equipments under dispatch.
- 4.2.2 Photograph with illustrations identifying the various component/subsystems and showing location of items.

4.3 INFORMATION TO BE SUPPLIED ALONGWITH EQUIPMENT:

4.3.1 For each complete 4 bay VHF FM circularly polarized antenna **two** printed & duly bound copies of manuals and books for Installation, Testing, Commissioning, Operation, Maintenance, Fault diagnosis are to be supplied to each consignee.

4.3.2 Six Complete set, of these documents i.e. **printed & duly bound** set of *Installation, Commissioning, Operation & Maintenance* manuals for complete 4 bay VHF FM circularly polarized antenna (pressurized) against the order are required to be sent to (irrespective of number of antenna ordered), the following officers / offices / places:

4.3.2.1	DE(Proj.), P&D Unit, DG:AIR	- 1 sets
4.3.2.2	Zonal Office (Project Wing)	- 1 set
4.3.2.3	Zonal Office (Maintenance Wing)	- 1 set
4.3.2.4	DE(Transmitter Maintenance), DG:AIR	- 1 set
4.3.2.5	Technical Library, P&D Unit, DG:AIR	- 1 set
4.3.2.6	Staff Training Institute (Technical)	- <u>1 set</u>
	Total	- <u>6 sets</u>

One Soft copy of these documents is also required on CD for use with PC to be delivered to DE(Proj), P & D Unit, DG AIR .

4.3.2.7 One copy of the Pre-despatch Performance Test at manufacturer's work as per ATP and Inspection Report - carried out at factory - should also be sent to Director(Project), P&D Unit, DG:AIR and each consignee.

4.4 DELIVERY OF EQUIPMENT

Within three months from date of placing of order

- 4.6 Availability of the Antenna spares : up-to 10 years
4.7 Guarantee /Warranty : 18 months after receipt at site.

4.8 (Optional) Spares: Antenna installation accessories and tools kit. (Items wise details of offered and included material , items &part are to be given by the tenderer) .

SECTION - II (TECHNICAL SPECIFICATIONS)

1.0 INTRODUCTION:

The 4 bay VHF FM circularly polarized antenna (pressurized) is required for use with FM transmitters of All India Radio for multi frequency as well as single frequency operation in tropical condition of heavy rainfall & high humidity and arid desert regions. The transmitter will be procured by AIR separately and will conform to ITU-R standards. Two or more transmitters are likely to be combined/multiplexed and fed to this antenna, therefore, the antenna should be truly wide-band in the frequency range.

The tenderer is required to offer complete Antennae System (pressurized), comprising of Dipoles, Inter bay RF coaxial air dielectric feeders, Power Splitters including Rigid Lines, Fine Tuning arrangement (on site), Lightning protection Kit for Antennae, and similar other Accessories for the completeness of offered Antennae System. The entire Antennae System (pressurized) offered should comply with the provision of this specification pertaining to power handling capacity, mechanical & electrical characteristics.

- 1.1** The Antenna will be installed on one leg of the existing self-supporting steel latticed TV tower of height 122 M. The FM antenna will be mounted between 87.7M to 97.7 M on one leg of existing TV tower.
- 1.2** The entire system of 4 bay VHF FM antenna shall be fully pressurized i.e. from the transmitter's output RF co-axial air dielectric cable, antenna input main power divider /splitter, RF co-axial air dielectric branch feeders, sub power dividers / splitters, RF co-axial air dielectric distributors cables and all the dipole elements of the 4 bay VHF FM antenna system offered by the tenderer.
- 1.3** Following equipment and items will be procured by AIR separately.
 - 1.3.1 The transmitter, which will conform to ITU-R standards.
 - 1.3.2 RF co-axial cable (air dielectric), rigid lines (for inter connections of transmitter Chain in the Transmitter Hall), dehydrator, dummy load and RF switch (for selection of Antennae or Dummy load) etc.
 - 1.3.3 Self-supporting latticed tower (Existing TV tower).
 - 1.3.4 A Stainless steel / GI pipe will be installed on the tower by AIR for fixing the four(4) Dipoles / Bays.

All the items required for the "4 bay VHF FM antenna system (pressurized)

" offered by the tenderer shall be supplied by the tenderer except equipment and items mentioned above in para No.1.3.1 , 1.3.2, 1.3.3 and 1.3.4

2.0 TECHNICAL SPECIFICATION:

2.1 ELECTRICAL PARAMETERS:

- 2.1.1 Polarization : Circular.
- 2.1.2 Input impedance : 50 ohm unbalanced.
- 2.1.3 Max. freq. deviation of transmitter. : ± 150 KHz.
- 2.1.4 Frequency band : 88 -108 MHz.
- 2.1.5 Operating frequency : Antennae are to be used for multi frequency operation .
The "centre frequency of operation" is likely to be within the band from 100.0 Mhz to 104.0 Mhz.
- Exact " operating frequencies" and "operating band" shall be intimated at the time of placement of order.
- 2.1.6 VSWR
- 2.1.6.1.1 : Better than **1.12 : 1** within the operating bandwidth of **10 MHz**.
- 2.1.6.1.2 **VSWR value in graph form** over entire VHF FM Band-II range of 88-108 MHz is to be enclosed with tender.
- 2.1.7 Continuous **Average Power rating** : 40 kW.
- 2.1.8 Downward beam tilt : 1.5 deg.
- 2.1.9 Null filling : Required, 10%.
- 2.1.10 4 bay Antenna Gain : ≥ 3.0 dBd (actual value to be indicated in the tender).
(Gain figure is for each polarization i.e Horizontal & Vertical and which shall be given by the tenderer separately).
(4 bay antenna shall be circularly polarized as per 2.1.1).
Note : (Gain figure is to be submitted in dBd only i.e. with respect to half

wave dipole.)

- 2.1.11 No. of vertical Bays (Dipoles) : 4 Nos.
- 2.1.12 Spacing between Bays : 0.7 to 0.8 λ . Actual distance to be indicated in tender, and a drawing to be enclosed.
- 2.1.13 Antenna Mounting details : The Antenna will be installed on one leg of the existing self-supporting steel latticed TV tower of height 122 M . The FM antenna will be mounted between 87.7M to 97.7 M on one leg of existing TV tower as above .

The four (4) dipoles of the FM Antenna will be mounted on a GI / stainless steel pipe on one leg of the tower. Expected field pattern (circular polarisation) with such a supporting tower should be submitted along-with the tender. Details for carrying out field adjustments for ensuring that actual Radiation Pattern (Horizontal and Vertical plane) conform to AIR specification, **if any**, in the field **or** at site are to be enclosed with the tender.

- 2.1.14 Radiation pattern (along with antenna mounted on the tower):

- 2.1.14.1 Horizontal plane : The “radiation pattern” should be Omni-directional.
Gain variation should be ± 1.5 dB in free space.
Expected Gain of 4 bay antenna system should be **within 3.0 dB from maximum.** (along with antenna mounted on the tower)
Antennae radiation pattern over **0° to 360°** for Vertical & Horizontal vectors are to be submitted with the tender by the tenderers.
- 2.1.14.2 Vertical Plane : Expected pattern for **0° to $\pm 90^\circ$** in vertical plane for Vertical and Horizontal vectors should be submitted with the tender.
- 2.1.15 Inter-bay feeding / Feed System : Full details of Feeding arrangement and the Engineering drawings with dimensions; along-with the details of Inter-connecting RF co-axial air dielectric cables / rigid lines etc to be submitted with tender. The entire feeding system should be adequately protected against heavy rainfall, snow

fall extreme daily temperature variance.

2.1.16 Lightning protection : Antenna should be DC grounded. Additional details for complete lightning protection to be provided for Antennae installation . (Items wise details of offered and included material , items & part are to be given by the tenderer)

2.2. MECHANICAL DETAILS:

2.2.1(i) Antenna Weight : ≤ 200 Kg
2.2.1(ii) Antenna Wind Load : ≤ 300 Kg
2.2.1(iii) Maximum Wind Speed : 198 km. per Hr.

2.2.2.1 Ice Loading : Yes.
2.2.2.2 Deicing : Complete deicing system is required .
(Antenna system should be able to with stand ice loading). (Item wise details of the offered material , are to be given by the tenderer)

2.2.3 External material of Dipoles and rigid feed lines: Exterior of dipoles will be made of stainless steel or Marine Brass and Rigid lines with Marine Brass or Copper.

2.2.4 **Internal material (for Power Divider, Rigid lines & interconnecting feed cables / lines) :** Inner lines of Dipoles will be of copper, Brass or Aluminium & those of Power Dividers will be of copper or Brass. All electrical contacts will be silver plated. All inners and bullets ---- of connecting head or mating head - will be made of Beryllium copper and silver plated. Insulators will be made of virgin Teflon.

2.2.5 **Pressurization** : Required for entire Antennae system as per para 1.0 and 1.2 of Section -II (technical specifications) and complete pressurization details for the Antennae system are to be submitted by the tenderor.

2.2.6 Max. Ambient Temperature / RH : -20 to 45 ° C , RH 95% NC.

2.2.8 **Input connector** -- main power divider of antenna system : To match with 3 -1/8" EIA Flange connector, RF output of FM transmitter will be available through the 3-1/8" EIA Flange connector mounted on 3-1/8" RF co-axial air dielectric cable.

2.2.9 **Set of clamps** : Suitable clamps for dipoles, Power Divider / Splitter and RF co-axial air dielectric cables / rigid lines etc. are to be

included in the offer and the mechanical details (dimension & materials used etc) be indicated in the tender.

2.2.10 The entire Antennae System should be adequately protected against snow, Heavy rainfall & Humid climate of Tropical Region. Each component / Sub system of the Antennae System should be adequately tropicalised for extreme weather conditions . The Antennae system should also be well protected against dust / sand / smog as well as desert conditions of extreme day & night temperature variance.

2.2.11 **Dead weight and wind load (Kg):** Full technical details for complete antennae system shall be submitted by the tenderer along with the tender in the format given below:

SNo.	Description	Dead Weight (Kg)	Wind load (Kg) At wind speed 198 Km /hr	Wind load (Kg) At wind speed 180 Km /hr	Wind load (Kg) At wind speed 160 Km /hr
1.	Single dipole				
2.	Single bay circularly polarized antenna				
3.	Two bay circularly polarized antenna				
4.	Four bay circularly polarized antenna				
5.	Antenna power dividers, distributors, main RF co-axial air dielectric branch cables, distributors cables etc.				
7.	Antenna clamps hardware etc.				

2.2.12 Continuous Average Power Rating (KW) etc. : Continuous Average Power Rating (KW) and full technical details for complete antennae system shall be submitted by the tenderer along with the tender in the format given below:

SNo.	Description	Continuous average power rating (KW)	VSWR	Size
1.	Single dipole antenna i.e. for horizontal or vertical polarization.			
2.	Single bay circularly polarized FM antenna.			
3.	Two bay circularly polarized FM antenna.			
4.	Four bay circularly polarized FM antenna			
5.	antenna input main RF power divider /splitter (as per design of manufacturer)			
6.	main branch RF co-axial air dielectric feeder cables/RF coaxial rigid lines. (as per design of manufacturer)			
7.	sub power dividers / splitters (as the case may be / as per design of manufacturer)			
8.	distributors RF co-axial air dielectric feeder cables/ RF coaxial rigid lines. (as the case may be / as per design of manufacturer)			

2.2.13 Gain: : Gain figures for shall be submitted by the tenderer along with the tender in the format given below:

SNo.	Description	Gain Circularly polarization (dBd) *	Gain Horizontal polarization (dBd)*	Gain Vertical polarization (dBd)*
1.	Single dipole antenna i.e. for horizontal or vertical polarization			
2.	Single bay circularly polarized FM antenna			
3.	Two bay circularly polarized FM antenna			
4.	Four bay circularly polarized FM antenna			

Note :* Gain figures must be submitted in dBd only i.e. gain with respect to half wave dipole .

SECTION - III

SCHEDULE OF REQUIREMENTS / MATERIALS (UNPRICED)

[FOR ONE SET OF 4 BAY CIRCULARLY POLARIZED VHF FM ANTENNA (PRESSURIZED)] (With Ice loading) (For antenna to be mounted on the leg of TV tower at Srinagar TV Site)

[PART- "A"]

S NO.	Spec. clause ref.	Description	Qty
1.	Sec.-II (Technical Spec.)	4 bay VHF FM Circularly polarized antenna fully pressurized as per details given below in compliance to AIR Specification No: Xth plan/4 BAY VHF ANTENNA /FM /1/October - September 2006/-D(TD/FM)	1 Set Complete
		i) antenna input main RF power divider /splitter (as per design of manufacturer)	
		ii) main branch RF co-axial air dielectric feeder cables/ RF co-axial rigid lines. (as per design of manufacturer)	
		iii) sub power dividers / splitters (as per design of manufacturer)	
		iv) distributors RF co-axial air dielectric feeder cables/ RF co-axial rigid lines. (as per design of manufacturer)	
		v) all the dipole elements of the 4 bay VHF FM antenna system (as per design of manufacturer)	
		vi) fine tuning arrangement . (as per design of manufacturer)	
		vii) Deicing system complete (Items wise details of offered material are to be given by the tenderer)	
		Any other accessories offered for the completeness of the system (Items wise details of offered and included material , items & part are to be given by the tenderer)	1 lot
2.	Sec. I (General)	Instruction (Installation, commissioning , Operational & Maintenance) manuals printed and duly bound - along with one soft copy on CD (within one months of acceptance of tender) - one for DE (Proj.) P&D Unit, DG: AIR (irrespective of number of 4 bay VHF FM Circularly polarized antenna fully pressurized ordered) - one for each consignee { Within one Months of Supply order)	1 set +1 set for each consignee.

S NO.	Spec. clause ref.	Description	Qty
3.1	Sec. I (General)	{ To be supplied along with the equipment} Complete set of printed and duly bound (Installation, Testing ,Commissioning, Operation, Maintenance, Fault diagnosis) documents For each Consignee.	2 Sets
3.2	Sec. I (General)	<p>{ To be supplied along with the equipment} (irrespective of number of 4 bay VHF FM Circularly polarized antenna fully pressurized ordered, following 6 nos of document are to be supplied) Against Each order for the complete 4 bay VHF FM circularly polarized antenna system. Complete set of printed and duly bound (Installation, Testing, Commissioning, Operation, Maintenance, Fault diagnosis) documents for the following officers:</p> <p>2.2.1 DE (Proj.),P&D Unit, DG:AIR - 1 set 2.2.2 Zonal Office (Project Wing) - 1 set (One for each Zone) 2.2.3 Zonal Office (Maintenance Wing) - 1 set (One for each Zone) 2.2.4 DE(Transmitter Maintenance), - 1 set DG:AIR 2.2.5 Technical Library, - 1 set P&D Unit, DG:AIR 2.2.6 Staff Training Institute - <u>1 set</u> (Technical)</p> <p style="text-align: right;">Total - <u>6 set</u></p> <p>One Soft copy on CD for DE(Proj), P & D Unit, DG AIR</p>	6 sets

Total of PART -“A” :

SECTION-III (B)

OPTIONAL ITEMS:

[FOR ONE SETOF 4 BAY CIRCULARY POLARIZED VHF FM ANTENNA (PRESSURIZED)] (With Ice loading) (For antenna to be mounted on the leg of TV tower at Srinagar TV Site)
PART-“B”

S NO.	Spec. clause ref.	Description	Qty
1.	Sec.-II	(Optional) Spares: Antenna installation accessories and tools kit. (Items wise details of offered material are to be given by the tenderer)	1 Set

Total of Optional Items PART-“B”: