PRASAR BHARATI
(INDIA's PUBLIC SERVICE BROADCASTER)
AKASHVANI AND DOORDARSHAN

Tender No.: ADG(BO)(NEZ)/ERECTIONOFTOWER/DW/2026-27-Part(1)

Name of work : Design, Supply, Erection, Testing and Commissioning (DSETC) of 50 Meter Self Supporting Lattice Steel Tower including provisions of mounting for installation of VHF FM Antenna etc. for FM station at Akashvani Jiribam(Manipur).

TECHNICAL COMPLIANCE — Annexure-D1

Name of the Contractor

Sl.No.	Particulars	Firm's compliance Yes/No	Tenderer's offer Make And Model	Remarks
1	**1. FABRICATION AND DESIGN** **1.1 Tower steel section:** **(**i) All tower members shall be made out of structural steel conforming to IS:2062 amended to date, **High Tensile Structure Steel.** (ii) The main members in legs, bracings, horizontals etc, **shall not be less than 6 mm thick.** (iii) The secondary members, like hand-rails, ladders etc. **shall not be less than 5 mm thick.** (iv) In case certain steel sections are not available in the market in the designed thickness, the next higher thickness available should be used. (v) The bidder shall arrange for procurement of Zinc required for galvanizing the structure by him. The rate of fabrication shall be inclusive of the cost of Zinc and galvanization. The Zine required for galvanizing shall conform to 1S: 209 amended to date or IS:13229 amended to date.			
	1.2 Fasteners (Bolts, nuts and washers): **(i)** Assembly of tower members and other structures on tower shall be by means of nuts and bolts alongwith locking nuts/spring washers of approved design as per AIR specification/approved drawings and Riveting and welding, if the design demands, shall conform to relevant IS specifications. (ii) The quality of steel used for nuts, bolts, washers ete, should confirm to mechanical properties as per IS:1367 amended to date and dimension to IS:6639 amended to date. (iii) The boits shall be as per design requirement and minimum property class 5.6 as specified in IS:1367 amended to date and matching nut property class as specified in IS:1367 amended to date. (iv) Nuts should be double chamfered as per the requirement of IS: 1363 amended to date. (V) The shear, bearing & tensile strength shall be in accordance with IS:800 amended to date. The fasteners shall be procured from reputed manufacturers such as UNBRAKO, TVS SUNDRAM etc. (vi) All the bolts and nuts shall be galvanized by high temperature hot-dip galvanizing in accordance with IS:1367 amended to date. Thickness of galvanizing coating shall also be in accordance with the environmental condition at tower site considering life of tower as 100 years and as per relevant BIS codes. The washers, spring washers shall be hot-dip galvanized as per Grade 4 of IS:1573 amended to date. (vii) Nut Rotation From Snug Tight Condition:As per Table **[Scope of work, Page 8, 2.1.2 (vii)]** Alternatively nuts may be tightened using a calibrated wrench so that the proof load of the bolt specified in IS: 1367 amended to date is achieved. "Snug tight is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in remaining holes in the connection and brought to snug tight position".			
	1.3 Fabrication: (i) The fabrication of tower components shall conform to 1S:800 amended to date. (ii) All steel sections shall be fabricated as per the approved drawings. (iii) Gas cutting, shearing, sawing, modification of holes, welding etc. is not permitted for finished members at the site.			
	1.4 Drilling and punching: (i) Holes for bolts shall be drilled or punched with jig, but drilled holes shall be preferred. Punching may be adopted for thickness up to 5 mm. Tolerances regarding punched holes are as follows. a. Holes must be perfectly circular and no tolerance in this respect will be permissible. b. The maximum allowable difference in diameter of the holes on the two sides of plates or ungles shall be 0.8 mm i.e., the allowable tolerance in punched holes should not exceed 0.8 mm on diameter. (ii) Drilled & punched holes must be square with the plates or angles and have their wall parallel. (iii) Holes on both side of the bend line in a bent member shall be drilled after bending. (iv) The mild steel section up to 75×75×6 may be bent by cold process up to bend angle 10° and all other angle sections and bend angles shall be bent by hot process. (v) The formation of bends by the "Cut & Weld" method unless specified in drawings is not permitted without prior approval of Akashvani. (vi) No angle member shall have two leg flanges brought together by closing the angle.			
	1.5 Welding: (1) Welding, if any, shall be carried out in accordance with IS:816, IS:1024 and IS:9595 amended to date as ppropriate. (ii) Butt welding shall be carried out either by submerged arc or shielded arc welding. (iii) Pre-heating and post heating shall be employed as may be necessary for welding members. (iv) For welding of any particular type of joint, welder shall give evidence, acceptable to Akashvani of having satisfactorily completed appropriate tests as described in relevant BIS codes.			
	1.6 Tolerance: Fabrication tolerances shall not exceed those specified in IS:7215 amended to date as applicable to group B structures.			

1.7 Galvanizing:
(i) All steel tower members shall be hot dip galvanized after fabrication is completed. The galvanizing of the tower members shall conform to IS:2629 and IS:4759 amended to date.
(ii) The thickness of hot dip galvanizing shall be generally **85 microns** (equivalent to 610g/m² of Zinc Coating) in accordance with IS:4759 amended to date. However higher coating shall be employed if tower site's environmental & pollution condition warrants so, in accordance with Table I of IS:4759 amended to date for hot dip galvanizing.
(iii) All galvanized members shall withstand test as per IS:2633 & IS:3203 amended to date.
(iv) All fasteners shall be galvanized in accordance with IS:1367 amended to date.
(v) Spring washers shall be electro galvanized as per Grade 4 of 1S:1573 amended to date.

1.8. All steel used shall be galvanized, conforming to relevant IS specification i.e. 1S:2629 amended to date for tower members, IS: 1367 amended to date for fasteners and IS:1573 amended to date for washers.
19. The overall force co-efficient for wind load on tower shall be taken from IS: 875-1987 amended to date for Self-Supporting Lattice Steel Towers. For calculating the solidity ratio, actual obstruction area of tower shall be considered. Separate Wind obstructing areas shall be taken for ladder, cable rack and platforms etc.
1.10. The basic dynamic wind pressure at different heights for different zones shall be taken from the Indian Standard Code.
1.11. The basic wind velocity for the site is to be taken from BIS Code No. IS:875-1987 amended to date.
1.12. The permissible stresses in the various structural members of tower shall be adopted from the relevant clauses of IS: 800 amended to date.
1.13. Loading effect due to antenna and various accessories as indicated at Para No. 2.8 will be taken into consideration.
1.14. Loading effect of seismic forces as per IS: 1893 amended to date and cyclonic winds and conditions of frost etc., if any, is also be taken into consideration.
1.15. Weight of the tower should not be less than **30 MT** (Excluding foundation steel).

2.1 FOUNDATION

2.1.1 The tenderer is advised to impect the tower site and acquaint himself with the local terrain & site conditions, soil conditions, nature of sub soil, water table and its seasonal variations, area contours etc. and to make such local enquiries, as may be necessary for any data required by him, before quoting his rates. Ground has to be properly leveles after erection of the tower & cleared of all debris etc. Foundation is to be protected by provision of pitching work on sloping terrain to protect the foundation from erosion.

2.1.2 For the purpose of this bid, the tenderer shall quote the rates (in the commercial bid) on the basis of **8.2 MT/ Sq. M Soil Bearing Capacity (SBC) at 2 m depth.** The tenderer shall also quote for "Extra for reduced Soil Bearing Capacity (SBC) below **8.2 MT/Sq. M for every 0.55 MT/Sq. M decrease."**

2.1.3 The successful tenderer shall carry out soil tests through NABL approved Laboratory. When a test boring is conducted, all safety requirements are to be taken adhered from human safety aspect. Complete test observations will have to be recorded and furnished to Akashvani. After taking samples, the bored hole should be closed properly.

2.1.4 The cement, sand and concrete used shall be of best grade and the concrete shall preferably be mixed in a mechanical mixer in the standard ratio 1:2:4. The foundation shall be watered and cured for at least 14 days and the erection of the tower shall be commenced only after the foundations are thoroughly cured. Measurements of levels of all tower footings will be taken in the presence of AIR representative.

2.2 VERTICALITY TOLERANCES, DEFLECTION, TWIST & SWAY:

2.2.1. UNDER STILL AIR CONDITIONS:
2.2.1.1 The tower shall be vertical after erection and no straining shall be permitted to achieve this. The verticality of tower shall be within the provisions of Table-1(III) (b) of IS: 12843:1989 amended to date, viz. ± H/1500 or ±25 mm (whichever is less) for towers over 30 M height i.e. the bottom of the line joining to the centre of the top of the tower and the centre of the base of the tower shall be within this limit. (H refers to the height of the tower).

2.2.2 UNDER MAXIMUM WIND LOAD CONDITIONS:
2.2.2.1 The maximum deflection of the axis of tower shall not be more than 1/100 of tower height from vertical at various levels including top, under maximum wind and other critical loading condition.
2.2.2.2 The angular twist shall not exceed 0.5 degree.
2.2.2.3 The sway shall not exceed 0.5 degree.

2.3 PROTECTION AGAINST LIGIITNING:
The tower shall be provided with a suitably designed complete system of lightning protection in accordance with the relevant latest IS code including necessary earthing based on the specific resistivity of the soil and sub-soil water level. The lightning protection system shall be got approved from All India Radio, before execution. Copper strip of size **50 mm × 3 mm** is to be provided for Lightning Arrester from top of the tower to the ground to be connected to tower earthing system.

2.4 PAINTING

The details regarding painting of tower are given below:-
(a). For Non-coastal Area
2.4.1 The tower shall be given one coat of ETCH primer (2 Pack) followed by two coats of Zinc Chromate primer
and two or more coats of synthetic enamel paint after erection. The tower shall be painted to have equal alternate bands of international orange and white colours with top and bottom bands painted in orange as
per latest International Civil Aviation Organization Recommendations.
2.4.2 The paints used in painting shall be in accordance with IS: 2074, IS: 2932 & IS: 2933 amended to date.
2.4.3 Etch primer shall conform to IS: 5666 amended to date and Priming of Zinc Chromate shall conform to IS: 104 amended to date.
2.4.4 Painting shall be done in accordance with IS: 1477 Part I & II amended to date.
2.4.5 The minimum dry film thickness shall be 8 microns of ETCH primer, 40 microns of each coat of Zinc Chromate primer and 40 microns of each coat of synthetic enamel paint. The overall Dry Film Thickness (DFT) should not be less than 168 microns.

(b). For Coastal Area
2.4.6 The tower shall be given one coat of ETCH primer (2 Pack) followed by two coats of Epoxy Red Oxide Zine Phosphate Weldable primer(Two component) and two or more coats of Polyurethane Full Gloss Enamel(Two Pack) paint after erection. The tower shall be painted to have equal alternate bands of international orange and white colours with top and bottom bands painted in orange as per latest International Civil Aviation Organization Recommendations.
2.4.7 The paints used in painting shall be in accordance with IS: 13213 amended to date.
2.4.8 Etch primer shall conform to IS: 5666 amended to date and Epoxy Red Oxide Zinc Phosphate Weldable
primer (Two components) shall conform to IS: 14506 amended to date.
2.4.9 Painting shall be done in accordance with IS: 1477 Part I & II amended to date.
2.4.10 The minimum dry film thickness shall be 8 microns of ETCH primer, 25 microns of each coat of Epoxy Red Oxide Zinc Phosphate Weldable primer(Two component) and 35 microns of each coat of Polyurethane Full Gloss Enamel (Two Pack) paint. The overall Dry Film Thickness (DFT) should not be less than 128 microns.

2.5 EARTHING

All the four tower legs shall be earthed individually, following the standard practice of earthing of such structures in level ground and mountainous regions (Details shall be attached with the tender). The Earth resistance of the tower earthing shall be less than 1 ohm. A suggestive **drawing No. TM-16597 (Scope of work, Page No.-22)** for earthing is enclosed.

2.6 FACILITIES ON TOWER:

The following facilities are required to be provided on tower:

2.6.1. PLATFORM:

Provision of platform for access to the antenna and cables at different levels to be made as indicated in Annexure-11. 1.5 meter high handrails would be provided at each level with expanded metal net for additional safety. Platform flooring will consist of chequered plate conforming to IS:3502 amended to date and shall be designed as to take stationary and moving load of 4 persons plus equipment (weighing about 100 Kg.). At each platform "Toe-plates"(6") as a form of protection against accidental dislodging of small tools, are to be provided.

2.6.2 LADDERS:

2.6.2.1 An internal ladder of width not less than 300 mm starting from ground level of the tower and going up to the top with openings at all the platforms shall be provided. The ladder shall be foldable/retractable at the ground level and length of foldable/ retractable portion of ladder should not be more than 1.5M. The ladder shall be hooped type with **FREE FALL PREVENTION SYSTEM** for safety of the climbing personnel. The face on which the ladder is to be provided shall be intimated by Akaalivani before the commencementof erection of tower.

2.6.2.2 Rungs of the ladder shall be clear of any obstructions to the climber and equally spaced by not more than 250 mm.

2.7.3 AVIATION OBSTRUCTION LIGHTS & POWER SUPPLY CABLES:

a) LED based Aviation Obstruction Lights including beacon light (with twin aviation obstruction light arrangement in 'ON' duty and 'STANDBY mode with alarm monitoring) should be provided. The globes and their housings shall be strong, weather proof and of approved manufacturer. There shall be 2 lights located diagonally at each level, except the top level. The aviation obstruction lighting arrangement shall be as per latest International Civil Aviation Organization Recommendations.
b) Power supply load of the aviation lights shall be evenly distributed on all the three phases, in order to ensure that with failure of the single phase all the lamps at each level do not go off. The power supply cable for the lights shall conform to IS: 1554 amended to date or the power supply cables for the aviation lights shall be liberally rated and shall conform to the latest Indian Standard specifications.
c) One No., 3 Core, 6 Sq. mm copper conductor (Stranded), XLPE insulated, sheathed, weatherproof, armoured Power Supply cable for Multipoint power sockets on each platform shall be supplied and laid & clamped to the cable rack. This cable shall be terminated in SP&N MCB of suitable rating in a suitable weather proof metal box at the tower base including the earthing etc. Power sockets with switches of suitable rating shall be provided and suitably mounted at each platform in weatherproof boxes.
d) Two Nos. 4 core, suitably rated, copper conductor, XLPE insulated, sheathed, weather proof, armoured power supply cable for AOL shall be provided and laid on vertical Cable Tray and fixed with cable clamps. This cable shall be terminated in TP&N MCB of suitable rating in a suitable weatherproof metal box at the tower base including the earthing etc.
e) Distribution of supply to Aviation Obstruction Lights shall be through suitable weatherproof junction boxes with suitable mounting.
f) The successful tenderer shall provide temporary Aviation Obstruction Lights during erection of tower as soon as the tower reaches the height of 25 meters or such heights as prescribed in latest International Civil Aviation Organization Recommendations.
g) A "Sun Switch" is required to be provided for AOL so that these are "ON" automatically, if sufficient sunlight is not available around tower. In no case, Sun Switch is to be installed inside a room or covered space.
h) The details of Power Supply arrangements for aviation obstruction lights shall be provided with the tender.
2 i) The LED based AOL offered shall be approved by National Physical laboratory (NPL)/ERTL/and test report for the same must be submitted with the offer as well as with the material.
j) The detailed circuit diagram of the AOL, No. of LEDs used, details of configuration of LEDs (series parallel arrangement etc.) should be submitted with the offer.

2.7.4 CABLE RUN-WAY AND ANTENNA SUPPORTING FIXTURES:

2.7.4.1 Vertical Cable Rack/Tray:
The vertical cable rack for laying cables as indicated in Para 2.8.2 starting from the base to the top of the tower shall be provided. This cable rack shall be routed along the tower face or leg and should be just behind the climbing ladder or be a part of this for easy accessibility. The cable rack shall carry all the RF feeder cables, AOL & Service cables etc. It should have provisions for fixing the cable clamps. Reference drawing No. TM-16640 is enclosed.

2.7.4.2 Side Mounted FM Antenna Fixtures:
Provision for fixing 100 mm inner dia. supporting seamless GI pipe Class "C" of 18 M length for side mounting VHF FM Pole type Antenna as per drawing No. TM-15404 shall be made on three faces of the tower. This supporting pole will be fixed in VHF FM Band -II Aperture on one of the three faces, to be intimated at the time of erection of tower. The fixtures of the antenna shall not foul with the cable routing from the power divider to the antenna. The above pipe shall be supplied by the tenderer as part of tower.

2.7.4.3 Top Mounted second channel FM Antenna Fixtures:
Provision is to be made for fixing 100 mm inner dia. seamless GI pipe category Class "C" of 12 M length as per suggestive drawing nO. TM-16239 for top mounting VHF FM Pole Type Antenna for second channel in future.

2.7.4.4 Horizontal Cable Rack/Tray:
The cable run hetween the tower base & transmitter building shall be through a horizontal cable tray to be provided by the tenderer. The rack will be supported on 75 mm inner dia. Class "C" G.1. pipes or 60-60×5mm G.1. angle iron structures & the rack will be covered by Semi Circular or suitable design 16 SWG G.L. sheet cover. The tenderer must quote for the horizontal cable rack on the basis of **per meter rates**. The pricing for horizontal cable rack should include the laying charges of all cables on this tray. Reference drawing No. TM-14453/3 is enclosed. Pipes or angle frames should be grouted with RCC in ground as per practice and have a height of 4 Mtrs. from the ground.

2.8. TOWER LOADING DETAILS DUE TO FM ANTENNA,YAGI ANTENNA, MICROWAVE DISH & RF CABLES ETC.

2.8.1. The following Net weight and Wind loading figures may be taken into consideration in respect of Antenna, cables etc. Ice loading shall also be taken into design as per site requirement, if required. These are in addition to self loading of tower.
[**See Table at Annexure -D, Page -13, under 2.8.1**]

2.8.2 The following cables are to be installed on tower. Wind loading due in these may also be taken into consideration. **[See Table at Annexure -D, Page -13, under 2.8.2]**
(Items are to be supplied by tenderer including lugs, connectors etc.)

2.8.3. The weight and wind load of VHF FM antenna fixtures and 100 mm inner dia. seamless G.1. pipe Class "C" of 18M length is required to be taken into consideration for loading by the tenderer as per design.

2.9. WORKMANSHIP:
a. All workmanship for foundation work shall be in accordance with specifications, approved drawings and IS: 456 amended to date.
b. The tenderer shall carryout excavation in all kind of soils. While excavating, excavation shall be adequately supported or formed to ensure stability of the sides and prevents any damage to the surrounding ground or structures.
c. Excavation material suitable for re-use as backfill shall be stored within the site working area.
d. For excavation in cohesive soil the final 150 mm above foundation bottom level shall only be removed immediately prior to placing to M10 concrete pad.
e. The tenderer shall not permit water accumulation in excavated pit.
f. The tenderer shall carry out concrete trial mix using representative materials. Mix proportioning shall be carried out under full scale condition as per IS: 10262 amended to date. The testing shall be carried out in accordance with IS: 456 amended to date. Minimum three test cubes shall be tested.
g. The aggregate and cement shall be proportioned by means of efficient weigh batching machines. The machine shall be maintained & cleaned periodically.
h. The concrete shall be mixed in batches, in concrete mixing machines, which shall comply to IS Codes. Manual or hand mixing is not permitted.
i. The tenderer shall carry out slump or other workability tests as required during concreting of work, in order to relate the degree of workability of the mix to the values obtained during the trial mix.
j. All frameworks shall be accurately constructed to produce the correct foundation shape and shall be sufficiently strong to withstand pressure arising from concrete during placement and compaction.
k. Reinforcement bar shall be bent and fixed in accordance with procedure specified in IS: 2502 amended to date. The high strength deformed steel bars should not be re-bent, straightened. All the reinforcement should be placed and maintained in the position as shown in the drawing by providing proper block, spacers and supporting bar.
l. The concrete shall be placed in layer maintaining proper cover of reinforcement, which shall be compacted by vibrators.
m. The curing & protection shall be as per BIS standards, after compaction of the concrete and shall ensure adequate protection.
n. Backfilling shall be compacted in 300 mm layers to achieve a bulk density of not less than 1.7 MT/m³.
o. The tenderer shall clear the site from all surplus soil and other materials before handing over the tower to Akashvani.
p. Inspection and testing of concrete work shall be in accordance to provisions of IS: 456 amended to date.
q. In case of rock anchorage type foundation, workmanship & other requirements shall be in accordance with IS: 10270 amended to date.

	2.10 MARKING OF MEMBERS Each individual tower member shall carry a stamped mark (number) assigned to in the approved drawings. These stamping shall be done by a metal die of 16 mm size before galvanizing and on optimum depth so as to clearly legible after galvanizing. A plate indicating the name of the tower, Specification No., AT No., Manufacturer's identity and year of manufacture shall be supplied by the tenderer for display at the bottom of the tower.			
	2.11 PACKING The material shall be boxed or bundled for transport in the following manner: **a.** Angle shall be packed in bundles securely wrapped four times around at each end and over 900 mm with No. 9 SWG gauge wire with ends twisted tightly. Gross weight of any bundle shall not exceed 450 Kg. **b.** Angles, brackets, plates and similar small loose pieces shall be tested and bolted together in multiples, and securely wired together through holes wrapped round at least four times with No. 9 SWG steel wire and ends twisted tightly. Gross weight of each bundle shall not exceed 70 Kg. **c.** The correct numbers of bolts, nuts and washers plus extra bolts, nuts and washers for the tower shall constitute a packing unit and shall be dispatched packed in crates or wooden boxes strong enough to withstand the normal vigorous transit and handling. The various sizes of bolts, nuts and washers shall be kept in separate bags inside the main container. Each container shall carry a list of the bolts contained therein printed in water-proof ink, resistant to moisture. Weight of the container shall not exceed 70 Kg.			
	2.12 MARKING OF PACKGES Each bundle or package shall have the following details marked on it. **a.** The name and address of the Consignee. **b.** The relevant marks and number of tower members or reference of bolts, nuts and small components like gusset plates, various attachments etc. for easy identification. **c.** The marking shall be stenciled in indelible ink on the top member of the bundle of tower steel and on wooden boxes or gunny bags containing smaller components. **d.** Akashvani shall, in no case, be responsible for loss of any package or bundle during transit. It shall be the responsibility of the bidder to replace the lost items free of cost.			
	2.13 ADITIONAL ITEMS OF WORK **Mounting of Antenna system:** After the erection of the tower, the tenderer shall also mount VHF FM Antenna, RF cable, junction boxes etc, on the tower as per details. The antenna system and RF feeder cables will be provided by AIK. For the sake of completeness of works, the tenderer may have to undertake minor/major items of works that may become necessary for the mounting of antenna system mentioned hereto.			