



PRASAR BHARATI
(INDIA'S PUBLIC SERVICE BROADCASTER)
O/o ADDITIONAL DIRECTOR GENERAL (E) (WZ)
ALL INDIA RADIO & DOORDARSHAN
P.B. ROAD, WORLI, MUMBAI-30.



File No.: ADE(E-WZ)/AIR-P/DSECT_100M_TOWER_AKASHVANI_DAHOD/2026-27
Computer No. 349377

Dated: 13/08/2026

Subject: - Invitation of Budgetary Quote for Design, Supply, Erection, Testing and Commissioning (DSETC) of 100M Self Supporting Lattice Steel tower at Akashvani Dahod as per details in the Budgetary Quote Form.

1. The budgetary quote form of the upcoming tender is enclosed herewith to offer quotations, from prospective bidders/firms with budgetary quote.
2. Bidders/firms may please submit the above details/their quote on or before date 28-08-2026 by e-mail to mpingle@prasarbharati.gov.in, rsbhamare@prasarbharati.gov.in, ddgairprojectwz@gmail.com and mumbai.airproject@gmail.com or at following address.

Shri Mohan P. Ingle
Deputy Director Engineering
O/o Additional Director General (E) (WZ)
Akashvani & Doordarshan, 3rd floor, A.O.A building
Doordarshan Complex, Worli, Mumbai – 400030
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e-mail id: mpingle@prasarbharati.gov.in,
rsbhamare@prasarbharati.gov.in,
ddgairprojectwz@gmail.com
mumbai.airproject@gmail.com

Due Date to submit quotation: 28/08/2026

Enclosed:

- Budgetary Quotation form of the upcoming tender is enclosed herewith.
- Technical Specification at Annexure-1 for Design, Supply, Erection, Testing and Commissioning (DSETC) of 100M Self Supporting Lattice Steel tower at Akashvani Dahod

(Mohan P. Ingle)
Deputy Director (E)
For Add. Director General (E), WZ
MUMBAI





PRASAR BHARATI
(INDIA'S PUBLIC SERVICE BROADCASTER)
O/o ADDITIONAL DIRECTOR GENERAL (E) (WZ)
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Last date of receipt of budgetary quotation in this office:28/08/2026 up to 15:00Hrs.
Please read carefully the terms and conditions given the enquiry quotation form and Specifications Enclosed.

Sr. No.	DESCRIPTION / SCOPE OF WORK	Qty	RATE	AMOUNT
1.	Design, Supply, Erection, Testing and Commissioning (DSETC) of 100M Self Supporting Lattice Steel tower at Akashvani Dahod (Technical Specifications attach in Annexure-1) Address of site: - Akashvani Dahod Behind welfare council Oppo. Panchmukhi Hanuman ji Mandav road, Dahod -389151	1 Job		
Total				
CGST				
SGST				
IGST				
Grand Total				

Supply of material and Work at site:-

I	SUPPLY (A)			
Sl No	Description of Item/Work	Make & Model	Qty	Unit
1	Supply of 100M tower superstructure materials as per AIR Specification complete as required. # Quantity in Metric Ton (MT) offered to be mentioned by tenderer.		#MT	MT
2	Supply of Vertical ladder materials with Free Fall Prevention system complete as required.		1	Lot
3	Supply of Vertical Cable Rack/Tray materials as per specification complete as required. (Rate per meter shall be quoted)		100	M

4	Supply of Horizontal Cable Rack/Tray materials as per specification complete as required. (Rate per meter shall be quoted)		25	M
5	Supply of 100 mm inner dia. category Class 'C', seamless GI pipe of 18 M length.		1	Job
6	Supply of LED based Aviation Obstruction Light including beacon light (with twin aviation obstruction light arrangement in 'ON' duty and 'STANDBY' mode with alarm) along with Sun-Switch, Control Panel (with MCBs, alarm indicators etc.), Power Supply Cable and accessories etc. complete as required.		1	Set Complete
7	Supply of Lightning Arrester materials/arrangements including earthing materials for separate earthing (2 Nos. earthing) along with Copper strip of size 50 mm × 3 mm from top of the tower to the ground with lug etc. complete as required.		1	Set Complete
8	Supply of 3 Core, 6 Sq.mm, Copper Conductor (Stranded), XLPE insulated, Sheathed, armoured, weather proof Power Supply Cable with lugs etc. complete as required.		130	M
9	Supply of 32 A, SP&N MCB along with weather proof metal boxes with multipoint power sockets and switches at base and each platform, earthwire etc. complete as required.		1	Set Complete
10	Supply of tower earthing system materials for 100M tower (4 Nos. earthing) along with copper strips as per specification.		1	Set Complete
11	Any other item (s) required for the completeness of the DSETC of 100 M tower. Item wise details (including part No., if any) are to be given by the tenderer.		1	Set
	Total of Supply (A)			
II	WORKS (B)			
1	Preparation and submission of design documents & design drawings of Foundation and Tower structure approved by any IIT/SERC along with certificate from IIT/SERC testifying the soundness and safety of design of foundation and tower structure as per AIR specification (in hard & soft copies) to Zonal ADG (E). (Within two Months of issue of Acceptance of Tender) - 2 Sets Complete		1	Job
2	Excavation of earth & casting of tower foundation including Supply of complete raw materials, hardware, labour, site clearance etc. as per AIR specification complete as required.		1	Job
3	Fabrication, Galvanizing, Painting, Erection, Testing and Commissioning of 100M Self Supporting Lattice Steel tower at site as per AIR specification complete as required.		1	Job
4	Fixing of Vertical ladder with Free Fall Prevention System complete as required.		1	Job
5	Fixing of Vertical Cable Rack/Tray with clamps complete as required. (Rate per meter shall be quoted).		100	M
6	Fixing of Horizontal Cable Rack/Tray with clamps complete as required. (Rate per meter shall be quoted).		25	M

7	Fixing of 100 NB Class 'C', seamless GI pipe of 18 M length for mounting provisions for VHF FM Antenna complete as required.	1	1 Job
8	Painting of tower including paint materials complete as required.	1	1 Job
9	Fixing of LED based Aviation Obstruction Lights along with cable & MCB complete as required.	1	Job
10	Installation of Tower Lightning Arrester and earthing work (2 Nos. earthing) along with laying of copper strip of size 50 mm × 3 mm from top of the tower to the ground with lugs etc. complete as required.	1	Job
11	Hoisting of FM Side Mount Antenna-6 Bay complete as required	1	Job
12	Laying of RF Cable complete as required	1	Job
13	Laying of Power Supply Cable and fixing of weather proof metal boxes with Multipoint Power sockets and switches at base and each platform, fixing of 32 A, SP&N, MCB including connections, testing etc. complete as required.	1	Job
14	Earthing work for tower (4 Nos. earthing) completes as per AIR specification.	1	Job
15	Soil testing with detailed report & document(s) (in soft & hard copies)	1	Job
16	Inspection and certification for structural firmness, verticality and all other design specifications by any IIT/SERC after erection of tower and submission of inspection report & certificate (s) (in hard & soft copies) to Zonal ADG (E). -2 Sets Complete	1	Job
17	Preparation and submission of completion report including photographs showing complete tower as well as each section of 20 M length from base to top, horizontal cable tray and foundation processes starting of excavation, steel layout and reinforcements etc. to leveled finished foundation and submission of the same completion report (in soft & hard copies) to: (a) AIR Station -1 Set (b) Zonal Office -1 Set (c) AIR Directorate -1 Set	1	Job
18	Pre-dispatch inspection of tower materials at the works of tenderer/tower manufacturer	1	Job
19	Any other works required for the completion of DSETC of 100 M tower. Break up details of work are to be given by the tenderer.	1	Job
20	Additional charges for reduced soil bearing capacity below 8.2 MT/Sq. M for every 0.55 MT/Sq. M decrease.	1	Job
21	Additional charges for requirement of pile foundation or any other type of foundation as approved by any IIT/SERC due to typical soil condition/water table.	1	Job
	Total of Work(B)		

TERMS & CONDITIONS AND INSTRUCTIONS TO BIDDERS

1. Scope of Work: The order scope shall be strictly as defined in this form, technical specifications, and site requirements. Completeness of the analysis and reporting is the sole responsibility of the contractor.
2. Standard Practices: The contractor shall follow modern engineering practices, relevant BIS codes (IS 800, IS 875 Part 3, IS 1893, IS 11233), and STAAD Pro structural modeling standards.
3. Mandatory Site Visit: Bidders must visit Akashvani Dahod with prior permission of the Station In-charge before submitting their offer and obtain a Site Visit Certificate to be attached with the tender.
4. Prior Experience Criteria: The bidder must be experienced in similar structural analysis work. The contractor should have successfully completed similar works during the last 7 years ending previous month: three similar works each costing not less than 40% of estimated cost, OR two similar works each costing not less than 60%, OR one similar work costing not less than 80%.
5. Continuity of Service: Execution of field measurements and site assessment must be carried out without causing any disruption or break in existing broadcasting services at Akashvani Dahod.
6. Labour & Safety Regulations: The firm shall submit details/address proofs of all personnel employed for site work and issue ID cards. Any damage to station equipment/property during execution shall be made good by the firm.
7. Stability Certification: The final structural stability certificate and report must be vetted and issued by a recognized IIT or NIT.
8. Consignee & Delivery Site: Station In-charge / Installation Officer, Akashvani Dahod (Gujarat).
9. Completion Period: Execution of work and submission of complete report within 01 year from the date of work order.
10. Quote Validity: 120 days from the date of submission of budgetary quotation.
11. Payment Terms: 100% payment will be released after successful completion of scope of work, submission of comprehensive report, and submission of IIT/NIT stability certificate in good condition.

BIDDER DECLARATION & INFORMATION

- a) GSTIN No.: _____
- b) PAN No.: _____
- c) Firm's Name: _____
- d) Registered Address: _____

Declaration: We hereby declare that all the terms, conditions, and specifications given in this budgetary quotation form have been read, understood, and accepted by us.

(Seal & Signature of the Authorized Bidder)
Name (in Capital): _____
Designation: _____

Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II**PRASAR BHARATI***(India's Public Service Broadcaster)***DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)**

Specification for Design, Supply, Erection, Testing and Commissioning (DSETC) of 100 M Self Supporting Lattice Steel tower including provisions of mountings for installation of VHF FM Antenna etc. for FM Stations of All India Radio.

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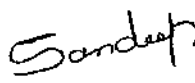
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6.	Annexure-II, Draft Acceptance Test Protocol for 100 M Self Supporting Lattice Steel tower	21-22
7.	List of annexure/drawings enclosed with the specification. (i) Annexure-I, Suggestive tower profile(general arrangement drawing) (ii) Annexure-VI, Mounting arrangement of FM Side Mount Antenna-6 Bay (iii) Annexure-IV, Mounting detail of Microwave Dish Antenna (iv) Drg. No. TM-14453/3, Details of Horizontal Cable Rack (v) Drg. No. TM-16640, Details of Vertical Cable Rack (vi) Drg. No. TM-16597, A suggestive Earthing drawing (vii) Annexure-V, Sketch showing deflection of the axis of tower (viii) Annexure-VII, Diagram explaining Twist in tower (ix) Annexure-VIII, Diagram explaining Sway in tower	Enclosures

A. ESSENTIAL REQUIREMENT FOR THE TENDER:

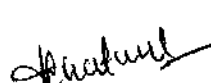
- (i). The tenderer should submit schedule of Requirements/Materials (un-priced) for DSETC *in the same format as given in AIR* Specification in the technical bid, failing which the tender shall be considered incomplete and is liable to be rejected.
- (ii). It is also mandatory to mention Make & Model of the offered equipment in the Schedule of Requirements/Materials (un-priced) for supply, failing which the tender shall be considered incomplete and is liable to be rejected.
- Each statement of the technical specification has to be complied with & supported by printed technical literature, technical data sheets, schematic drawings and technical manuals to assess the full merit of the offer, failing which the tender shall be considered incomplete and is liable to be rejected.
- The tenderer should submit the tender offer to All India Radio in the format given below, section wise & clause wise, in respect of all the sections of technical specifications. The tenderer/manufacturer of the tower must provide the page number reference, in column (4) of the table given below, of the Technical bid clearly indicating the volume number also, if any, for each supporting document to verify the parametric values shown in the technical specifications compliance statement, to assess the full

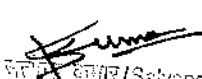

(Y.P. Singh, AE)


(Manzoor Ali, ADE)


(Sandeep Singh, DDE)

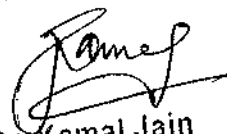

(Rajendra Nahar, DDE)


(Aditya Chaturvedi, DDG, E)


Sandeep Singh, DDE
(Sandeep Singh, DDE)

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Dr. Kamal Jain
Department of Civil Engineering
Indian Institute of Technology
Roorkee-247 667

Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II

merit of the offer, failing which tender shall be considered incomplete and is liable to be rejected..

S. No. of AIR Specification (Section wise & Clause wise) (1)	Details of AIR Specification (Part/ Section wise & Clause wise) (2)	Compliance (Yes/No) (3)	The Page No. of the tender offer, where the information/ supporting document is available (4)	Remarks (5)
Essential requirement for the tender				
Essential eligibility criteria for tenderer				
Section-I Clause wise				
Section-II Clause wise				
Section-III Clause wise				

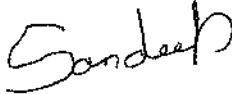
4. The complete technical specification compliance statement (section wise & clause wise) along with schedule of Requirements/Materials (un-priced) as per the format given above in clause A.(3) must be signed & stamped on each page by the tenderer/ manufacturer of the tower in the tender document. The tenderer/manufacturer of the tower should mention their name in CAPITAL LETTERS, full address with pin code, phone number, fax number, e-mail address and with their full signature.
5. The complete tender shall be page numbered.
6. The Authorization and Guarantee must be given by the tenderer/manufacturer of the tower on their letter head pad duly signed & stamped on each page. The Authorization and Guarantee other than the tenderer/ manufacturer of the tower in the tender will not be considered, failing which the tender shall be considered incomplete and is liable to be rejected.
7. Public Procurement (Preference to Make in India) Order No. P-45021/2/2017-B.E-II dated 15.06.2017 of Government of India, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion shall be applicable.
8. Any change/modifications in AIR technical specifications format, language, technical parameters or of any other nature including the deletion of clause, words, lines in the technical compliance statement by the manufacturer of the tower/tenderer will not be acceptable to AIR and the tender is liable to be rejected.

B. ESSENTIAL ELIGIBILITY CRITERIA FOR TENDERER:

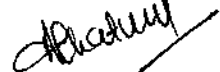
The essential eligibility criteria for this will be decided by the Zonal Office.


(Y.P. Singh, AE)


(Manzoor Ali, ADE)


(Sandeep Singh, DDE)

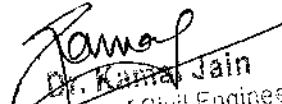
(Rajendra Nahar, DDE)


(Aditya Chaturvedi, DDG, E)


Sandeep Singh, DDE (AE)

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Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II**SECTION-I****1.0 INTRODUCTION:**

All India Radio requires 100 M Self Supporting Lattice Steel tower of mean probable design life of 100 years to support VHF FM antenna, Band-II FM Panel antenna, Microwave dish antenna, Mobile antenna etc. The tower shall be self-supporting type having square section base out of galvanized steel sections/structures of four legs. Provision of 650 mm × 650 mm cross section for mounting of FM Side Mount antenna on upper portion and 2500 mm × 2500 mm cross section below that for mounting of Band-II FM Panel antenna shall be made on the tower. Throughout the entire aperture for FM Side Mount antenna & Band-II FM Panel antenna, the outer to outer width of square cross section should be 650 mm & 2500 mm respectively (including splices, nuts & bolts at joints). A suggestive tower profile (general arrangement drawing) showing all the facilities and requirements as shown in Annexure-I is enclosed for reference.

The tower shall be designed to take self load and wind load as per details of load given at Para/c clause No. 2.8 of Section-II. Necessary provision of 650 mm × 650 mm cross section for mounting of TV antenna of UHF Band IV/V shall also be made at the top of tower.

1.1 SCOPE:

This specification aims at design, fabrication, supply, erection, testing and commissioning of 100 M Self Supporting Lattice Steel tower to support VHF FM antenna, TV antenna, Microwave dish antenna, Mobile antenna etc. as stated above, on turnkey basis.

The broad scope of the present tender includes the following as a turnkey job:-

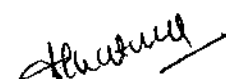
- Site visit to inspect the tower site and acquaint himself with the local terrain & site conditions, soil conditions, nature of sub soil, water table and its seasonal variations etc. and make such local enquiries, as may be necessary for any data required by him, before quoting his rates. *Otherwise, the tenderer will have to give an undertaking with the tender offer that any variation in the scope of works due to site condition shall be incorporated in the offered bid and AIR shall not consider any extra cost on account of that.*
- Soil testing from NABL approved laboratory.
- Preparation and submission of design documents & design drawings of Foundation and Tower structure approved by any IIT/SERC alongwith certificate from IIT/SERC testifying the soundness and safety of design of foundation and tower structure to Zonal ADG (E) (in hard & soft copies).
- Preparation and submission of general arrangement drawing(s) showing all the facilities and requirements as specified in the specification to Zonal ADG (E) (in hard & soft copies).
- Preparation and submission of working structural drawings and submitting to Zonal ADG (E) (in hard & soft copies).
- Construction of Foundation for tower.
- Fabrication, supply, erection, testing and commissioning of tower structure and tower appurtenances/accessories including antenna apertures, internal ladders with free fall prevention system for climbing from ground to top of the tower, platforms with railings, Vertical Cable tray & Horizontal Cable tray as per actual site conditions between transmitter building upto tower, pipe for mounting of FM Side Mount antenna, fixture for mounting of Microwave dish Antenna etc.
- Painting of the tower structure.
- Providing protection against lightning, earthing of tower, Aviation Obstruction Lights (AOL) including Beacon light and sun-switch. The power supply cable for multi point power sockets at various platforms, from bottom to the topmost platform of the tower, will also be supplied by the tenderer.
- The cables for AOL and utility outlets at various platforms shall be taken on tower on the vertical cable rack.
- Hauling up of FM Side Mount antenna [6-Bay VHF FM (Pole type) Antenna] and RF Feeder cable as supplied by AIR.

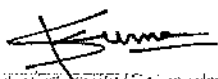

(Y.P. Singh, AE)


(Manzoor Ali, ADE)


(Sandeep Singh, DDE)

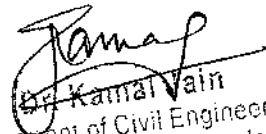

(Rajendra Nahar, DDE)


(Aditya Chaturvedi, DDG, E)


Sandeep Singh, DDE (E)

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- l. The RF feeder cable and other cables i.e. cables for AOL, power supply etc. between the transmitter building and the tower base shall be routed on a horizontal cable tray supported on G.I. Poles/Angle Iron structure which will be supplied by the tenderer. The cables on the horizontal cable tray shall be provided with G.I. sheet cover of 16 SWG to avoid any damage to RF cable due to any falling objects.
- m. Ground has to be properly leveled after erection of the tower & cleared of all debris etc.
- n. Joint inspection with representative(s) of the firm and AIR.
- o. Joint inspection of pending works as pointed out during joint inspection with representative(s) of the firm and AIR.
- p. Inspection and certification for structural firmness, verticality and all other design specifications by any IIT/SERC **after erection of tower** and submission of inspection report & certificate(s) (in hard & soft copies) to Zonal ADG (E).
- q. Handing over of tower with completion report (in soft & hard copies) including **videography & photographs** showing complete tower as well as each section of 20 M length from base to top, horizontal cable tray and foundation processes starting of excavation, steel layout and reinforcements etc. to leveled finished foundation.
- r. Any other work necessary to complete the DSETC work as a turnkey job.

1.2 GENERAL:

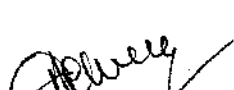
- a. General terms and conditions of contract for SETC works including all the commercial aspects like, Packing and Packing List, Insurance and Marine Risk etc., Payment terms, Penalty/Compensation for Delay, Damages and Liabilities, Time Period and Extension for Delay, Foreclosure of Contract due to Abandonment or Reduction in Scope of Work, Cancellation of Contract in Full or Part, Recovery of Security Deposit, Performance Guarantee, Unsatisfactory Workmanship, Damages Incurred During Installation, Indian Electricity Rules, Defects, Recovery of Compensation, Ensuring Payment and Amenities, Compliance with State Labour Laws, Minimum Wages Act Compliance, Indemnifying Government against Patent Rights, Return of Surplus Material, Employment of Technical Staff and Employees, Release of Security Deposit, Safety Code etc. shall be followed by the successful tenderer as defined in the tender document in totality.
- b. *The tender shall be complete and include all minor items of work and accessories which may not have been specifically defined in this specification and schedule but which are useful and essential for the perfect assembly and completion of the tower. No extra charges will be paid for providing and installing of such items.*
- c. The successful tenderer shall make his own arrangements for power supply, water and the storage of materials and their safe custody at installation site.
- d. The successful tenderer shall make his own arrangement for employing labour-skilled and unskilled and shall make his own arrangement for providing accommodation for his labour. He should conform to all local, State laws and regulations concerning labour and their employment.
- e. The successful tenderer shall make good all damage to the purchaser's buildings, property, equipment, article etc. howsoever arising from the construction of the foundation, erection of the tower, and in the course of such work and throughout the period during which the safety of the tower is guaranteed.
- f. The successful tenderer shall indemnify and hold harmless the purchaser against all claims in respect of damages to buildings, property, articles situated nearby, not belonging to the purchaser, howsoever arising from the construction of the foundation, erection of the tower, and in the course of such work and throughout the period during which the safety of tower is guaranteed.
- g. The successful tenderer shall indemnify and hold harmless the purchaser against claims in respect of injury/any mishap to any person, howsoever arising from the construction of the foundation, erection of the tower, and in the course of such work and throughout the period during which the safety of the tower is guaranteed.
- h. The successful tenderer shall fully discharge all obligations under the Indian Workmen's Compensation Act,


(Y.P. Singh, AE)


(Manzoor Ali, ADE)


(Sandeep Singh, DDE)


(Rajendra Nahar, DDE)


(Aditya Chaturvedi, DDG, E)


सत्येंद्र कुमार/ Satyendra B. Datta
उप महाप्रबंधक (सिस्टीम)/DDG (E&S)

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Indian Institute of Technology
Roorkee-247 667

Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II

any local, State laws and regulations in so far as it affects the workmen in his employment.

- i. The tenderer shall be responsible for safe erection of the tower and other accessories etc. The tenderer shall take all necessary safety measures and precautions during the SETC of the tower. Tower work shall be got done at site under the supervision of qualified representative(s) of the firm.
- j. The location of the tower at the site vis-à-vis the transmitter building will be marked by AIR on Site Lay Out Plan. Maximum area available, including excavation work, for tower will be 22 M × 22 M. * However, maximum area available, including excavation work, for tower at Rewa & Ludhiana will be 21 M × 21 M & 18 M × 18 M respectively.

1.3 DESIGN, CALCULATION AND DRAWINGS

- a. The tower shall be designed considering probability factor based on mean probable Design life of tower structure as 100 years.
- b. The tenderer shall obtain Wind Zones data as per IS: 875 amended to date and for seismic zone data as per IS: 1893 amended to date. The above data only shall be used in the Design Calculations. However, it may be kept in view that the wind map and seismic map are approximate only and require a judicious decision on the part of the designer to provide a good design of the tower for a design life of 100 years.
- c. It may also be ensured by the tenderer that if the site falls within a short distance from another wind zone having a higher basic wind speed, the tower shall be designed as per the higher basic wind speed.
- d. The specifications indicated herein are only to guide the tenderer about the requirements of the purchaser. Detailed design of the tower from all aspects shall be got worked out by the tenderer, keeping in view the effects of local meteorological conditions like wind velocity, seismic data, temperature, codal provisions and as per good engineering practice to ensure the safety of the tower..
- e. The design of the tower shall be based on recognized principles of structural design Engineering, conforming to latest IS codes and Standard Engineering Practices. **Full responsibility regarding soundness of design including factor of safety and the execution of work rests with the tenderer.**
For limit state of strength, partial safety factor for loads under worst atmospheric conditions and critical loadings shall be considered as a minimum 1.5 on any destabilizing load (including but not limited to, wind loads). If dead load contributes to the reduction of stresses or supports the stability for any particular action, suitable expected dead loads shall be considered.
- f. The overall force co-efficient for wind load on tower shall be taken from IS: 875 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.
- g. The permissible stresses in the various structural members of tower shall be adopted from the relevant clauses of IS: 800 amended to date.
- h. 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.
- i. **Loading effect due to antenna and various accessories as given at Para/clause No. 2.8 of Section-II will be taken into consideration.**
- j. The R.C.C foundation, tie beams etc, shall be designed and constructed in accordance with IS:11233 amended to date, IS:456 amended to date and other application codes. The minimum grade of concrete used shall be M-25.

1.4 The tenderer must furnish the following documents/information with the tender to assess the full merit of the offer, failing which the tender shall be considered incomplete and is liable to be rejected. This is mandatory requirement.

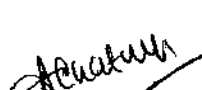
- a. (i) The general arrangement drawing(s) showing all the facilities and requirements as specified in the specification should be attached with the offer.
- (ii) Outline drawings to scale showing the assembly of the structures. These drawings should show the main

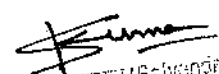

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dimensions including the size of main structural members, mounting centres, methods of attachment to concrete foundations and any special features of design or form.

(iii) Total weight of tower shall be given (Excluding foundation materials).

- c. Detailed information concerning design parameters such as loads due to wind effect & seismic effect, dead loads, antenna loads, combination loads considered, design philosophy along with other information which shall contain the following:
 - (i) Wind speed, terrain category, topographic factor, gust factor, risk factor etc.
 - (ii) Seismic zone factor, importance factor, response reduction factor etc.
 - (iii) Antenna loads due to FM Side Mount antenna, Band-II FM Panel antenna, UHF Band IV/V TV antenna at the top of tower, Microwave dish antenna, Mobile antenna etc.
 - (iv) Load combinations considered.
- d. The design calculations indicating the various formulas used for design, the bearing and shear stresses used for the design of bolted sections and the factors of safety adopted for the various structural components and materials.
For limit state of strength, partial safety factor for loads under worst atmospheric conditions and critical loadings shall be considered as a minimum 1.5 on any destabilizing load (including but not limited to, wind loads). If dead load contributes to the reduction of stresses or supports the stability for any particular action, suitable expected dead loads shall be considered.
- e. Typical design load calculation with methodology due to seismic effect.
- f. Details of Bill of Materials (BOM) showing Grade Designation and Quality of steel members, weight of the tower structure, details of fasteners, nuts, washers etc. & steel used in foundation.
- g. Design forces compression/tension due to critical load combination, design of main members panel wise i.e. leg, bracing (diagonal & horizontal) with section adopted, capacity of members based on length, slenderness ratio, allowable stress with reference & formula.
- h. Deflection at top of tower and reaction at base in most critical load combinations.
- i. The detailed design of foundations for **8.2 MT/Sq. M SBC**.
- j. Complete printed technical literature/technical data sheet/schematic drawings/detailed information of LED based Aviation Obstruction Light and details of Antenna Fixtures, Pipes, Power Supply cables, paint materials, earthing etc.
- k. Detail of activity wise Bar/PERT chart with delivery schedule.
- l. The complete technical specifications (Section wise & Clause wise) compliance statement alongwith Schedule of Requirements/Materials (un-priced) duly signed & stamped on each page by the tenderer/tower manufacturer as per the format given above in clause A (3).
- m. Details of past experience. **Refer clause B. Essential eligibility criteria for tenderer.**

1.5 The successful tenderer shall furnish the following documents/information within two months after issue of acceptance of tender:

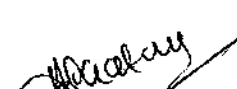
- (i) Soil testing with detailed report & document(s) (in hard & soft copies) -2 Sets
- (ii) Submission of general arrangement drawing(s) showing all the facilities and requirements as specified in the specification to Zonal ADG (E). (in hard & soft copies) -2 Sets
- (iii) Submission of design documents & design drawings of Foundation and Tower structure approved by any IIT/SERC alongwith certificate from IIT/SERC testifying the soundness and safety of design of foundation and tower structure to Zonal ADG (E). (in hard & soft copies) -2 Sets
- (iv) Detailed working structural drawings (in hard & soft copies) -2 Sets
- (v) Any other drawings for the completeness of the tower design as per AIR specification.


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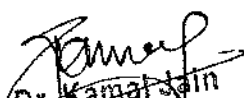

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The following references shall be indicated in the above design documents & design drawings, working structural drawings, general arrangement drawings etc. while submitting to concerned Zonal Offices.

(1) AIR AT No. (2) AIR Specification No. & (3) Approval of competent authority with signature & stamp.

After the acceptance of all working structural drawings by Zonal ADG (E), the successful tenderer shall send all working structural drawings to concerned Zonal ADG (E), concerned AIR Station(s) and AIR Directorate indicating all the references. All these working structural drawings as per AIR specifications must be available with all concerned offices before the start of the tower work at the site.

1.6 PATENTS AND COPYRIGHTS:

The tenderer shall hold the purchaser and his employees safe, harmless and immune from any liability that may arise out of infringements of patents and copyrights associated with the design, fabrication, erection and use of the tower and its accessories.

1.7 DELIVERY PERIOD:

The Delivery Period will be decided by the Zonal Office

1.8 INSPECTION & TESTS:**(a) Inspection will be done at various stages as follows: -**

1. Design verification and checking of drawings before commencement of construction/fabrication.
2. Inspection of soil excavation at foundation stage.
3. Material inspection before shifting at site. (This includes reports/certificates of different quality test from BIS /NABL approved lab(s) as mentioned below.
4. Inspection during excavation for foundation and after erection of tower.
5. Checking of Verticality tolerance etc. as per AIR specifications at the final stage i.e. after complete erection of tower.

(b) Test for strength of foundation: The concrete used in the foundation should be designed as per IS:10262 amended to date. Along with the foundation, cubes should be cast, which can be tested on 7 days and 28 days to get the strength of the concrete used in the tower foundation. Reinforcement used in the foundation must also be tested in a BIS/NABL approved Labs.**(c) Pre-dispatch inspection of tower material shall have to be got done by representative(s) of All India Radio in India by giving an advance notice of **TWO WEEKS**. The certifying agency IIT/SERC that will issue certification for structural safety & firmness, verticality and all other design specifications in compliance of clause 1.9 of Section-I will also be part of PDI. Pre-dispatch inspection of tower material and subsequent inspection of erected tower shall be done as per mutually accepted test procedure, which shall be submitted and got approved from All India Radio before the supply of tower material. A draft Acceptance Test Protocol as per Annexure-II is enclosed for guidance purpose. Travelling expenses for AIR's representative(s) will be borne by AIR.****d. Structural Steel:**

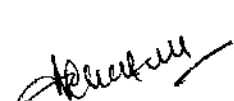
The tenderer shall procure all structural steel members from namely SAIL, TISCO and RINL. Structural steel sections not available from main producers can be procured from secondary producers subject to production of proof of manufacture of structural steel members from virgin billets produced from primary steel producers before starting fabrication work. Original copies of the test certificates of steel should be made available at the

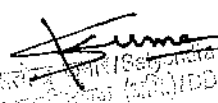

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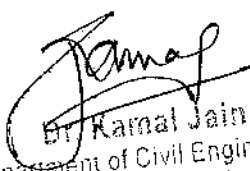

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time of inspection. Samples may be taken at the discretion of AIR and tested at BIS /NABL approved lab(s) as per provisions in this regard in the relevant IS codes, for which cost shall be borne by the tenderer. *In case the test results indicate that the Steel arranged by the tenderer does not conform to relevant IS Codes, the same shall be rejected..*

e. Fasteners:

Manufacturer's routine test certificates for bolts, nuts, washers etc. as laid down in relevant BIS code shall be submitted by the tenderer at the time of inspection. Samples may be taken at the discretion of AIR and tested at BIS /NABL approved lab(s) as per provisions in this regard in the relevant BIS codes, for which cost shall be borne by the tenderer. In case, the test results indicate that the Fasteners arranged by the tenderer does not conform to relevant BIS Codes, the same shall be rejected.

f. Galvanizing:

The tenderer shall prepare a detailed galvanizing procedure including Flow Chart with control parameters and all plant standards as required above and submit to AIR as part of Quality Assurance Plan.

g. All standard tests, including quality control tests, in accordance with appropriate BIS standard shall be carried out unless otherwise specified herein.

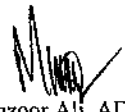
h. The following test certificates should be made available at the time of inspection. All the test certificates shall be issued by BIS /NABL approved lab(s).

1. History of metallurgy and Original copies of the test certificates of steel as per the format prescribed by BIS Code.
2. Manufacturer's routine test certificates for bolts, nuts, washers etc. as laid down in relevant BIS code.
3. All standard tests, including quality control tests, in accordance with appropriate BIS standard regarding galvanizing.
4. All standard tests for welds as per BIS.

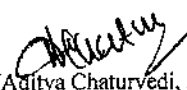
i. In addition to the provisions of clause regarding inspection, following shall also be included:

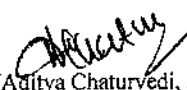
1. The tenderer shall keep AIR informed in advance about the time of starting and progress of manufacture and fabrication of various parts, so that it can be inspected, if required.
2. The acceptance of any part or items shall in no way relieve the tenderer of any part of his responsibility for meeting the overall requirement of the specifications.
3. Any member of the structure found not to comply with the approved drawings, shall be rejected. No member once rejected should be resubmitted for inspection except in case, where Inspecting Officer considers that the defect can be rectified.
4. All welded structures shall be subject to a non-destructive testing as per BIS code requirement and cost should be borne by the tenderer.
5. IS: 822 amended to date to be followed for inspection of welds and IS: 3600 (Part 1 to 9) amended to date to be followed for testing of welds.
6. All gauges, templates, jigs, fixtures, instruments necessary for inspection and testing shall be provided by the tenderer to AIR for the purpose of inspection.
7. To ensure effective in-process quality control, it is essential that the manufacturer arrange all the testing facilities for tests like, weight of zinc coating, tensile & shear strength, non-destructive testing of welds etc. The manufacturer should have proper quality assurance system in line with requirement of this specification.
8. Each Piece of steel work shall be distinctly marked before delivery in accordance with marking diagram and shall bear such and other marks as well to facilitate erection.
9. 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 be clearly legible after galvanizing.


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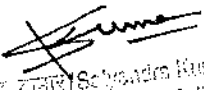

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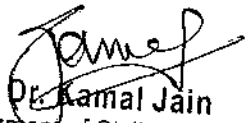

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1.9 CERTIFICATION & COMPLETION REPORT AFTER ERECTION OF TOWER:

- (a) After erection of tower, the tower structure shall be inspected and certified for its structural safety & firmness, verticality and all other design specifications by any IIT/SERC. Certified inspection report with all the observations, recommendations etc. shall be submitted to All India Radio. The recommendations/suggestions will have to be incorporated by the tenderer before submitting the final completion report. All costs on this inspection and post inspection corrections, if required, for completeness of the tower shall be borne by the tenderer. The concerned IIT/SERC should be made part of PDI in order to facilitate above certification.
- (b) The tenderer is also required to submit completion report colour printed and duly bound for the reference and record of All India Radio. A soft copy of the above must also be submitted.

1.10 GUARANTEE:

- 1) The tenderer shall guarantee the stability, safety, durability and satisfactory mechanical behavior of the structure under specified conditions of operation, wind pressure and loading, for a period of **FIVE** years from the date of the taking over of the tower.
- 2) In the event of structural failure or any component/part of the structure within the guarantee period specified above, the tenderer shall undertake to replace the components/parts which have failed and those which were damaged as a result thereof, free of cost and bear the expenditure to be incurred for re-erection of the tower.
- 3) All the Electrical/Electronic parts/materials such as AOL, Control Panels, cabling/wiring etc. shall be guaranteed for **FIVE** years from the date of handing over.


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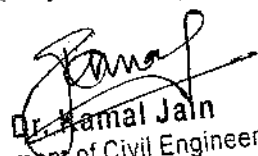

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SECTION-II**2.0 TECHNICAL SPECIFICATIONS:**

All the BIS Specifications referred herein after shall be read with the latest amendments i.e. upto the date of submission of tender offer.

2.1 FABRICATION AND DESIGN:**2.1.1 Tower steel section:**

- All tower members shall be made out of structural steel conforming to IS:2062 amended to date, **High Tensile Structural Steel**.
- The main members in legs, bracings etc, **shall not be less than 6 mm thick**.
- The secondary members, like hand-rails, ladders etc. **shall not be less than 5 mm thick**.
- In case certain steel sections are not available in the market in the designed thickness, the next higher thickness available should be used.

2.1.2 Fasteners (Bolts, nuts and washers):

- The tower members and other structures shall be connected/assembled by means of bolts and nuts with spring washers or locking nut.
- The quality of bolts should conform to mechanical properties as per IS:1367 amended to date and dimension to IS:6639 amended to date.
- The bolts shall be of minimum property class 8.8 as specified in IS:1367 (Part-3) amended to date.
- Nuts shall conform to IS:1363(Part-3) and appropriate property class as specified in IS:1367(Part-6) amended to date. Nuts should be double chamfered as per the requirement of IS:1363 amended to date.
- 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.
- All the bolts and nuts shall be galvanized by high temperature hot-dip galvanizing in accordance with IS:1367(Part-13) amended to date.
- The bolts shall be as per IS:12427 & IS:4000 amended to date.
- The plain and spring washers shall be hot-dip galvanized as per IS:1367 (Part-13) amended to date OR electro galvanized as per IS:1573 amended to date & IS:3655 amended to date, as applicable.
- Nut Rotation From Snug Tight Condition:

Bolt length (as measured from underside of head to extreme end of point)	A bolt faces normal to bolt axis	One face normal to bolt axis & other face sloped not more than 1:20 (bevel washer not used)	Bolt faces slope not more than 1:20 from normal to bolt axis (bevel washers not used).
Upto including 4 dia.	1/3 turn	1/2 turn	2/3 turn
Over 4 dia. but not exceeding 8 dia.	1/2 turn	2/3 turn	5/6 turn
Over 8 dia. but not exceeding 12 dia.	2/3 turn	5/6 turn	1 turn

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".


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- (i) The fabrication of tower components shall conform to IS: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.

2.1.4 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 angles 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 upto 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 AIR.
- (vi) No angle member shall have two leg flanges brought together by closing the angle.

2.1.5 Welding:

- (i) Welding, if any, shall be carried out in accordance with IS:816, IS: 2879, IS:1024 and IS:9595 amended to date as appropriate.
- (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 AIR of having satisfactorily completed appropriate tests as described in relevant BIS codes.

2.1.6 Tolerance:

Fabrication tolerances shall not exceed those specified in IS:7215 amended to date as applicable to group B structures.

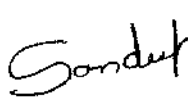
2.1.7 Galvanizing:

- (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 amended to date, IS:4759 amended to date & IS:4736 amended to date.
- (ii) The thickness of hot dip galvanizing shall be generally **120 microns** (equivalent to 860g/m² of Zinc Coating) in accordance with IS:4759 amended to date.
- (iii) The bidder shall arrange for procurement of Zinc required for galvanizing the structure. The Zinc required for galvanizing shall conform to IS: 209 amended to date or IS:13229 amended to date.
- (iii) All galvanized members shall withstand test as per IS:2633 amended to date.
- (iv) All the bolts and nuts shall be galvanized by high temperature hot-dip galvanizing in accordance with IS:1367(Part-13) amended to date.
- (v) The plain and heavy washers and spring washers shall be hot-dip galvanized as per IS:1367 (Part-13) amended to date OR electro galvanized as per IS:1573 amended to date, IS:3655 amended to date & IS: 3203 amended to date, as applicable.

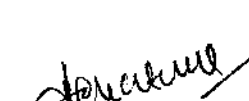
2.1.8 All the steps shall be taken by tenderer /manufacturer as per IS:9172 amended to date to prevent corrosion.

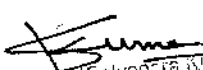

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2.2. FOUNDATION:

- (i) The tenderer is advised to inspect 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 for foundation of the tower.
- (ii) The R.C.C foundation, tie beams etc, shall be designed and constructed in accordance with IS:11233 amended to date, IS:456 amended to date and other application codes. The minimum grade of concrete used shall be M-25.
- (iii) 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 3 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."
- (iv) 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 All India Radio. After taking samples, the bored hole should be closed properly.
- (v) The cement, sand and aggregate used shall be of best grade and shall be mixed in a mechanical mixer as per the design. 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.
- (vi) Foundation is to be protected by provision of pitching work on sloping terrain to protect the foundation from erosion.
- (vii) In case of rock anchorage type foundation, workmanship & other requirements shall be in accordance with IS: 10270 amended to date.
- (viii) Anchorage bolts to concrete pedestal from tower is to be checked with the clauses mentioned in ACI: 318-14 Chapter 17.

2.3. VERTICALITY TOLERANCES, DEFLECTION, TWIST & SWAY:

2.3.1. UNDER STILL AIR CONDITIONS:

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. $\pm H/1500$ 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).

2.3.2. UNDER MAXIMUM WIND LOAD CONDITIONS:

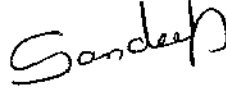
- (i) The horizontal deflection of the vertical axis of tower shall not be more than 1° (degree) at various levels including top, under maximum wind and other critical loading conditions. A sketch showing deflection of the vertical axis of tower as per Annexure-V is enclosed for reference only. The deflection at top of tower shall be checked as per the provision made in latest IS:800: 2007. The reaction at base shall be unfactored.
- (ii) The angular twist shall not exceed 0.5 degree.
- (iii) The sway shall not exceed 0.5 degree.

2.4. PROTECTION AGAINST LIGHTNING:

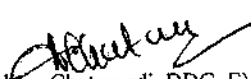
The tower shall be provided with a suitably designed complete system of lightning protection in accordance with provision of IS:2309 (amended to date) including necessary earthing based on the specific resistivity of the soil and sub-soil water level. The lightning protection system shall be got approved 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 along with separate earthing (2 Nos. earthing).


(Y.P. Singh, AE)

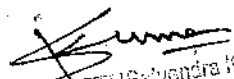

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Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II**2.5. PAINTING:**

The details regarding painting of tower are given below:-

(a). For Non-coastal Area

- (i) 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 Organisation Recommendations.
- (ii) The paints used in painting shall be in accordance with IS: 2074, IS: 2932 & IS: 2933 amended to date.
- (iii) Etch primer shall conform to IS: 5666 amended to date and Priming of Zinc Chromate shall conform to IS: 104 amended to date.
- (iv) Painting shall be done in accordance with IS: 1477 Part I & II amended to date.
- (v) 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

- (i) The tower shall be given one coat of ETCH primer (2 Pack) followed by two coats of Epoxy Red Oxide Zinc 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 Organisation Recommendations.
- (ii) The paints used in painting shall be in accordance with IS: 13213 amended to date.
- (iii) 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.
- (iv) Painting shall be done in accordance with IS: 1477 Part I & II amended to date.
- (v) 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.

2.6. 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 for earthing is enclosed.

2.7. FACILITIES ON TOWER:

The following facilities are required to be provided on tower:

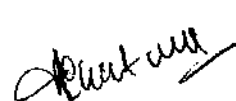
2.7.1. PLATFORM:

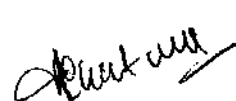
Provision of platform for access to the antenna and cables at different levels to be made as indicated in Annexure-I. 1.5 meter high handrails would be provided at each level with expanded metal net for additional safety. Platform flooring will consist of chequered plate conforming to IS:3502 amended 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.


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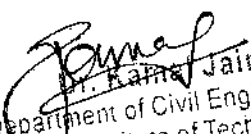

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Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II**2.7.2. LADDERS:**

- (i) An internal ladder of width not less than 450 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 All India Radio before the commencement of erection of tower.
The free fall prevention system shall confirm to EN -353-1 amended to date (Vertex PN 700). The wire shall be steel grade 316. The shock absorber shall be installed to reduce the impact if fall on victim as well as the structure. The intermediate shall be provided at every 10 m to reduce the vibration due to wind.
- (ii) Rungs of the ladder shall be clear of any obstructions to the climber and equally spaced by not more than 300 mm.

2.7.3 AVIATION OBSTRUCTION LIGHTS & POWER SUPPLY CABLES:

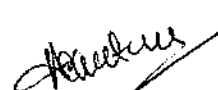
- a) LED based Aviation Obstruction Lights including beacon light (with twin aviation obstruction light arrangement in 'ON' duty and 'STANDBY' mode with alarm monitoring) should be provided. The globes and their housings shall be strong, weather proof and of approved manufacturer. There shall be 2 lights 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.
- 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.


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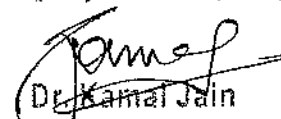

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Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II**2.7.4. CABLE RUN-WAY AND ANTENNA SUPPORTING FIXTURES:****a. Vertical Cable Rack/Tray:**

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. Vertical cable tray shall be provided as per drawing No. TM-16640.

b. Side Mounted FM Antenna Fixtures:

Provision for fixing 100 mm inner dia. supporting seamless GI pipe category Class "C" of 18 M length for FM Side Mount (Pole type) Antenna-6 Bay as per drawing No. TM-16599 shall be made on three faces of the tower. This supporting pole will be fixed in FM Side Mount antenna 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.

c. Top Mounted TV Antenna Fixtures:

Provision of 650 mm × 650 mm cross section for mounting of TV antenna of UHF Band IV/V shall also be made at the top of tower as shown in Annexure-I at later date.

d. Microwave Dish Antenna Fixtures:

Fixtures for mounting Microwave Dish Antenna shall be provided as per **Annexure-IV.**

e. Horizontal Cable Rack/Tray:

The cable run between 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. category Class "C" G.I. pipes or 60x60x5mm G.I. angle iron structures & the rack will be covered by Semi Circular or suitable design 16 SWG G.I. 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. Horizontal cable tray shall be provided as per drawing No. TM-14453/3 and shall be connected to vertical cable tray with intersection. 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, TV ANTENNA, MICROWAVE DISH, MOBILE ANTENNA, RF CABLES ETC. ARE GIVEN BELOW:

2.8.1. The tower shall be designed to take self load and wind load as per details of load given below. Ice loading shall also be taken into consideration as per site requirement, if required. These are in addition to self loading of tower.

S. No.	Description	Net weight (Kg)	Wind load (Kg)	Remarks
1.	FM Side Mount antenna-6 Bay (Pole Type)	600	900 @ 198 Km/hr. without ice	Weight & wind loading due to support column & mounting accessories not included.
2.	Band-II FM Panel Antenna	4800	7200 @ 198 km/hr. without ice	The weight is including supporting structure for FM Panel antenna

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3.	UHF Band IV/V TV antenna at the top of tower	1500	3500 @216km/hr. without ice	The weight is including supporting structure for TV antenna
4.	Microwave Dish Antenna -4 Nos. (Dia 1.8 M Solid)	90 each	To be calculated by the tenderer	Provision of 2 Microwave dishes each at lower & middle platform.
5.	Mobile Antenna	50 each set	50 each set	Provision of 6 Sets of mobile antenna between 25 M to 50 M

2.8.2. The following cables are to be installed on tower. Wind loading due to these may also be taken into consideration.

S. No.	Description of items with weight in Kg.	Qty.
1.	4" RF cable for FM antennas (Approx 3.50 kg/m)	4 Nos.
2.	5" RF cable for TV antenna (Approx 4.91 kg/m)	2 Nos.
3.	7/8" Coaxial cable for Microwave Dish antenna (Approx 0.50 kg/m)	4 Nos.
4.	7/8" Coaxial cable for Mobile Antenna (Approx 0.50 kg/m)	12 × 6 Nos.
5.	3 Core, 6 Sq. mm Power Supply cable*	1 No.
6.	Solid State Aviation Obstruction Light cable* etc. (with twin circuit arrangement)	2 Nos.

(* items are to be supplied by tenderer including lugs, connectors etc.)

2.8.3. The weight & wind loading due to mounting accessories of FM Side Mount antenna (6-Bay) and 100 mm inner dia. seamless G.I. pipe category "C" of 18M length is required to be taken into consideration for loading by the tenderer as per design.

2.9. WORKMANSHIP:

- All workmanship for foundation work shall be in accordance with specifications, approved drawings and IS: 456 amended to date.
- 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.
- Excavation material suitable for re-use as backfill shall be stored within the site working area.
- 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.
- The tenderer shall not permit water accumulation in excavated pit.
- 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.
- The aggregate and cement shall be proportioned by means of efficient weigh batching machines. The machine shall be maintained & cleaned periodically.
- The concrete shall be mixed in batches, in concrete mixing machines, which shall comply to IS Codes. Manual or hand mixing is not permitted.
- 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.
- 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.
- 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.

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- 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 AIR.
- 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.
- r. Testing of concrete quality is to be performed as per methods stated in IS: 516 -1959 (Reaffirmed 2004).
- s. If it is required to check the concrete strength in-site IS:1331(Part I & II, Reaffirmed 2004) method of test is to be performed.

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 Packages

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. AIR 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. Additional items of works**Mounting of Antenna system:**

After the erection of the tower, the tenderer shall also mount FM Side Mount antenna- 6 Bay (Pole Type), RF cable, junction boxes etc. on the tower. The antenna system and RF feeder cables will be provided by AIR.

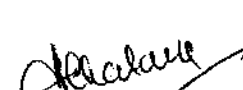
For the sake of completeness of works, the tenderer may have to undertake minor/major items of works that may become necessary for the mounting of antenna system mentioned hereto.


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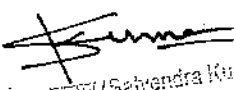

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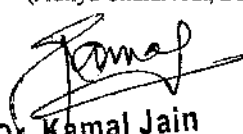

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SECTION-III

SCHEDULE OF REQUIREMENTS/MATERIALS (UN-PRICED) FOR 100 M SELF SUPPORTING LATTICE STEEL TOWER (FOR EACH SITE)

(I). SUPPLY OF MATERIAL AT SITE: (All the following items shall conform to detailed AIR Specification)

S. No.	DESCRIPTION	Make & Model	QTY.	UNIT
1.	Supply of 100M tower superstructure materials as per AIR Specification complete as required. # Quantity in Metric Ton (MT) offered to be mentioned by tenderer.		#MT	MT
2.	Supply of Vertical ladder materials with Free Fall Prevention system complete as required.		1 Lot	Lot
3.	Supply of Vertical Cable Rack/Tray materials as per specification complete as required.(Rate per meter shall be quoted)		100M	M
4.	Supply of Horizontal Cable Rack/Tray materials as per specification complete as required.(Rate per meter shall be quoted)		25M	M
5.	Supply of 100 mm inner dia. category Class 'C', seamless GI pipe of 18 M length.		1 Job	Job
6.	Supply of LED based Aviation Obstruction Light including beacon light (with twin aviation obstruction light arrangement in 'ON' duty and 'STANDBY' mode with alarm) along with Sun-Switch, Control Panel (with MCBs, alarm indicators etc.), Power Supply Cable and accessories etc. complete as required.		1 Set Complete	Set Complete
7.	Supply of Lightning Arrester materials/arrangements including earthing materials for separate earthing (2 Nos. earthing) alongwith Copper strip of size 50 mm × 3 mm from top of the tower to the ground with lug etc. complete as required.		1 Set Complete	Set Complete
8.	Supply of 3 Core, 6 Sq.mm, Copper Conductor (Stranded), XLPE insulated, Sheathed, armoured, weather proof Power Supply Cable with lugs etc. complete as required.		130M	M
9.	Supply of 32 A, SP&N MCB along with weather proof metal boxes with multipoint power sockets and switches at base and each platforms, earthwire etc. complete as required.		1 Set Complete	Set Complete
10.	Supply of tower earthing system materials for 100M tower (4 Nos. earthing) along with copper strips as per specification.		1 Set Complete	Set Complete
11.	Any other item (s) required for the completeness of the DSETC of 100 m tower. Item wise details (including part No., if any) are to be given by the tenderer.		1 Set	Set
	TOTAL OF SUPPLY (A)			

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(II). WORKS:

(All the following works shall conform to detailed AIR Specification)

S. No.	Description	Qty.	Unit
1.	Preparation and submission of design documents & design drawings of Foundation and Tower structure approved by any IIT/SERC alongwith certificate from IIT/SERC testifying the soundness and safety of design of foundation and tower structure as per AIR specification (in hard & soft copies) to Zonal ADG (E). (Within two Months of issue of Acceptance of Tender) - 2 Sets Complete		
2.	Excavation of earth & casting of tower foundation including Supply of complete raw materials, hardware, labour, site clearance etc. as per AIR specification complete as required.	1 Job	Job
3.	Fabrication, Galvanizing, Erection, Testing and Commissioning of 100M Self Supporting Lattice Steel tower at site as per AIR specification complete as required.	1 Job	Job
4.	Fixing of Vertical ladder with Free Fall Prevention System complete as required.	1 Job	Job
5.	Fixing of Vertical Cable Rack/Tray with clamps complete as required. (Rate per meter shall be quoted).	100 M	M
6.	Fixing of Horizontal Cable Rack/Tray with clamps complete as required. (Rate per meter shall be quoted).	25 M	M
7.	Fixing of 100 NB Class 'C', seamless GI pipe of 18 M length for mounting provisions for VHF FM Antenna complete as required.	1 Job	Job
8.	Painting of tower including paint materials complete as required.	1 Job	Job
9.	Fixing of LED based Aviation Obstruction Lights along with cable & MCB complete as required.	1 Job	Job
10.	Installation of Tower Lightning Arrester and earthing work (2 Nos. earthing) alongwith laying of Copper strip of size 50 mm × 3 mm from top of the tower to the ground with lugs etc. complete as required.	1 Job	Job
11.	Hoisting of FM Side Mount Antenna-6 Bay complete as required	1 Job	Job
12.	Laying of RF Cable complete as required	1 Job	Job
13.	Laying of Power Supply Cable and fixing of weather proof metal boxes with Multipoint Power sockets and switches at base and each platforms, fixing of 32 A, SP&N, MCB including connections, testing etc. complete as required.	1 Job	Job
14.	Earthing work for tower (4 Nos. earthing) complete as per AIR specification.	1 Job	Job
15.	Soil testing with detailed report & document(s) (in soft & hard copies)	1 Job	Job
16.	Inspection and certification for structural firmness, verticality and all other design specifications by any IIT/SERC after erection of tower and submission of inspection report & certificate (s) (in hard & soft copies) to Zonal ADG (E).- 2 Sets Complete	1 Job	Job
17.	Preparation and submission of completion report including photographs showing complete tower as well as each section of 20 M length from base to top, horizontal cable tray and foundation processes starting of excavation, steel layout and reinforcements etc. to leveled finished foundation and submission of the same completion report (in soft & hard copies) to: (a) AIR Station -1 Set (b) Zonal Office -1 Set (c) AIR Directorate -1 Set	1 Job	Job

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18.	Pre-dispatch inspection of tower materials at the works of tenderer/tower manufacturer	1 Job	Job
19.	Any other works required for the completion of DSETC of 100 m tower. Break up details of work are to be given by the tenderer.	1 Job	Job
	TOTAL OF WORKS (B)		
20.	Additional charges for reduced soil bearing capacity below 8.2 MT/Sq. M for every 0.55 MT/Sq. M decrease.	1 Job	Job
21.	Additional charges for requirement of pile foundation or any other type of foundation as approved by any IIT/SERC due to typical soil condition/water table.	1 Job	Job
	TOTAL OF WORKS (B)		



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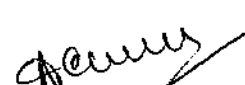


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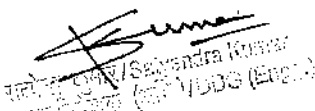
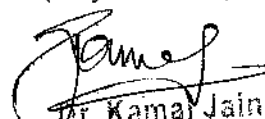
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Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II**ANNEXURE-II**

PRASAR BHARATI
(India's Public Service Broadcaster)
DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)

DRAFT ACCEPTANCE TEST PROTOCOL FOR 100 M SELF SUPPORTING LATTICE STEEL TOWER

AIR Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II for Design, Supply, Erection, Testing and Commissioning of 100 M Self Supporting Lattice Steel tower including provisions for mounting of VHF FM Antenna, Microwave Dish Antenna, Mobile Antenna and their feeder cables etc. may be referred.

I. PRE-DISPATCH TEST/ INSPECTION PROCEDURE:

In compliance with clause 1.9, the certifying agency such as the concerned IIT/SERC should also be part of PDI alongwith representatives of AIR.

A. Raw Material:

S. No.	Description	Specification	Procedure of Verification
1.	Structural Steel for tower members like M.S. Angles, M.S. Plates etc	As per IS amended to date or equivalent as specified in AIR specification in relevant clauses	Verification of Quality Control (Q.C.) reports/ test certificates submitted by supplier/Manufactures. Samples may be taken at the discretion of AIR and tested at BIS /NABL approved lab(s) as per provisions in this regard in the relevant IS codes, for which cost shall be borne by the tenderer.

B. Manufactured component / sub-assemblies:

S. No.	Description	Specification	Procedure of Verification
1.	Tower members fabricated as per approved design including Galvanizing, Fasteners, bolts, nuts and other accessories.	As per IS amended to date or equivalent as specified in AIR specification in relevant clauses	Verification of Quality Control (Q.C.) reports and checks shall be made on any chosen items for conformity with Quality Control reports. Samples may be taken at the discretion of AIR and tested at BIS /NABL approved lab(s) as per provisions in this regard in the relevant IS codes, for which cost shall be borne by the tenderer.

(Y.P. Singh, AE)

(Manzoor Ali, ADE)

(Sandeep Singh, DDE)

(Rajendra Nahar, DDE)

(Aditya Chaturvedi, DDG, E)

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(Signature)
 सत्येंद्र कुमार (Satyendra Kumar)
 प्रो. अभियंता (P.E.)/DDG (E&C)

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(Signature)
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 Roorkee-247 667

Specification No. 100 M(FM Tower)/37/November/2018-D(TD/FM)-Rev.II

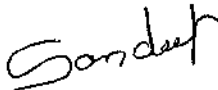
C. Accessories:

S. No.	Description	Specification	Procedure of Verification
1.	Cables a. Power Supply cable b. AOL power supply cable	As per AIR Specification	Verification of Quality Control (Q.C.) reports/Manufactures test certificates
2.	Lightning Arresters		
3.	AOL, Sun Switch & accessories		
4.	Copper earthing material		

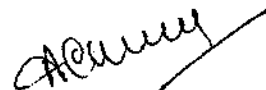
III: Test results and inspection report in respect of part-I (A, B, C) shall be submitted by the tenderer after inspection by the authorized inspecting officer of AIR.


(Y.P. Singh, AE)

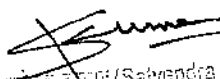

(Manzoor Ali, ADE)


(Sandeep Singh, DDE)

(Rajendra Nahar, DDE)


(Aditya Chaturvedi, DDG, E)

22

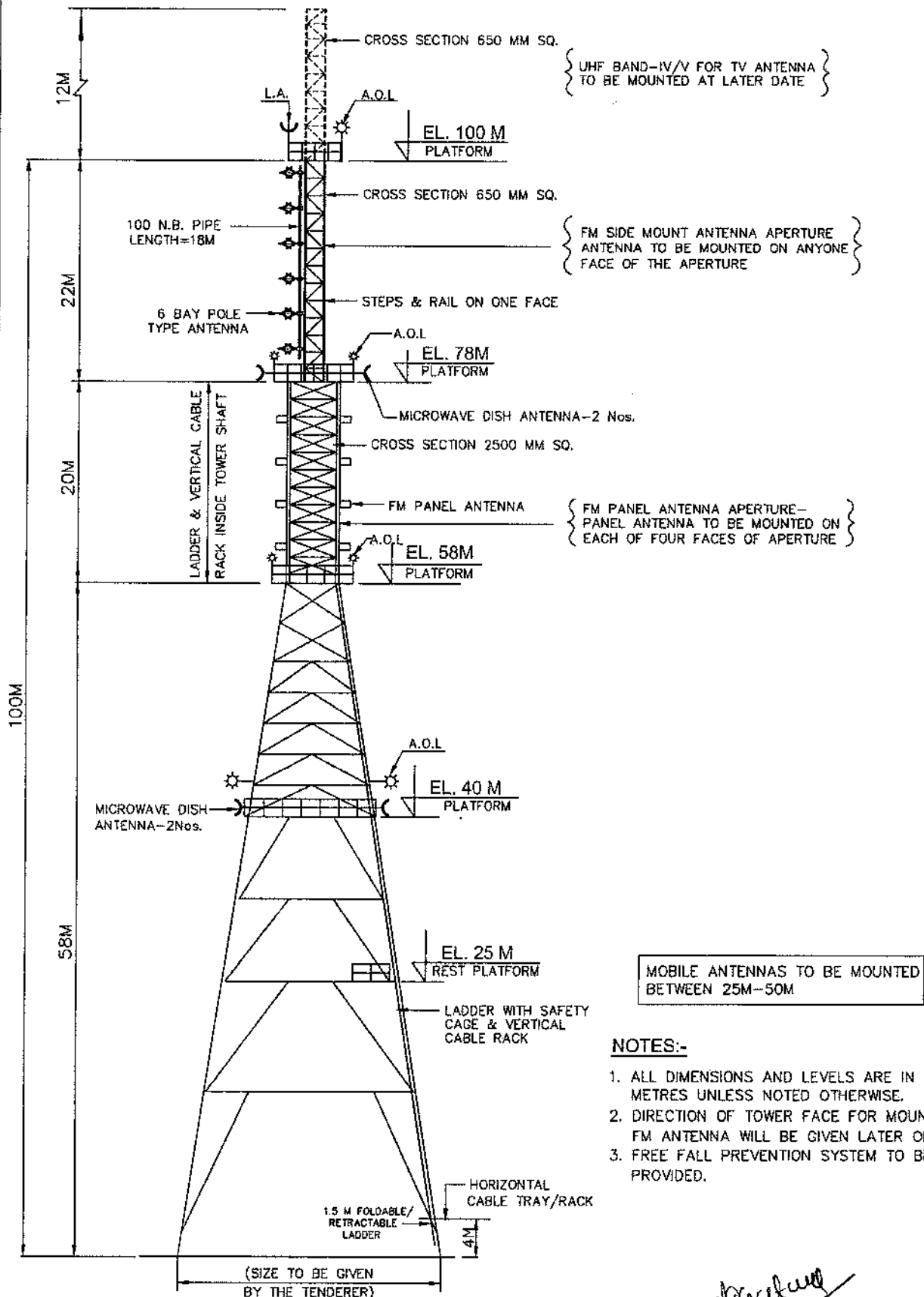

(Sanyendra Kumar, DDG (Eng.))

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100 METRE HIGH FM TOWER (FOR REFERENCE ONLY) SCALE: - N.T.S.

ANNEXURE - I



NOTES:-

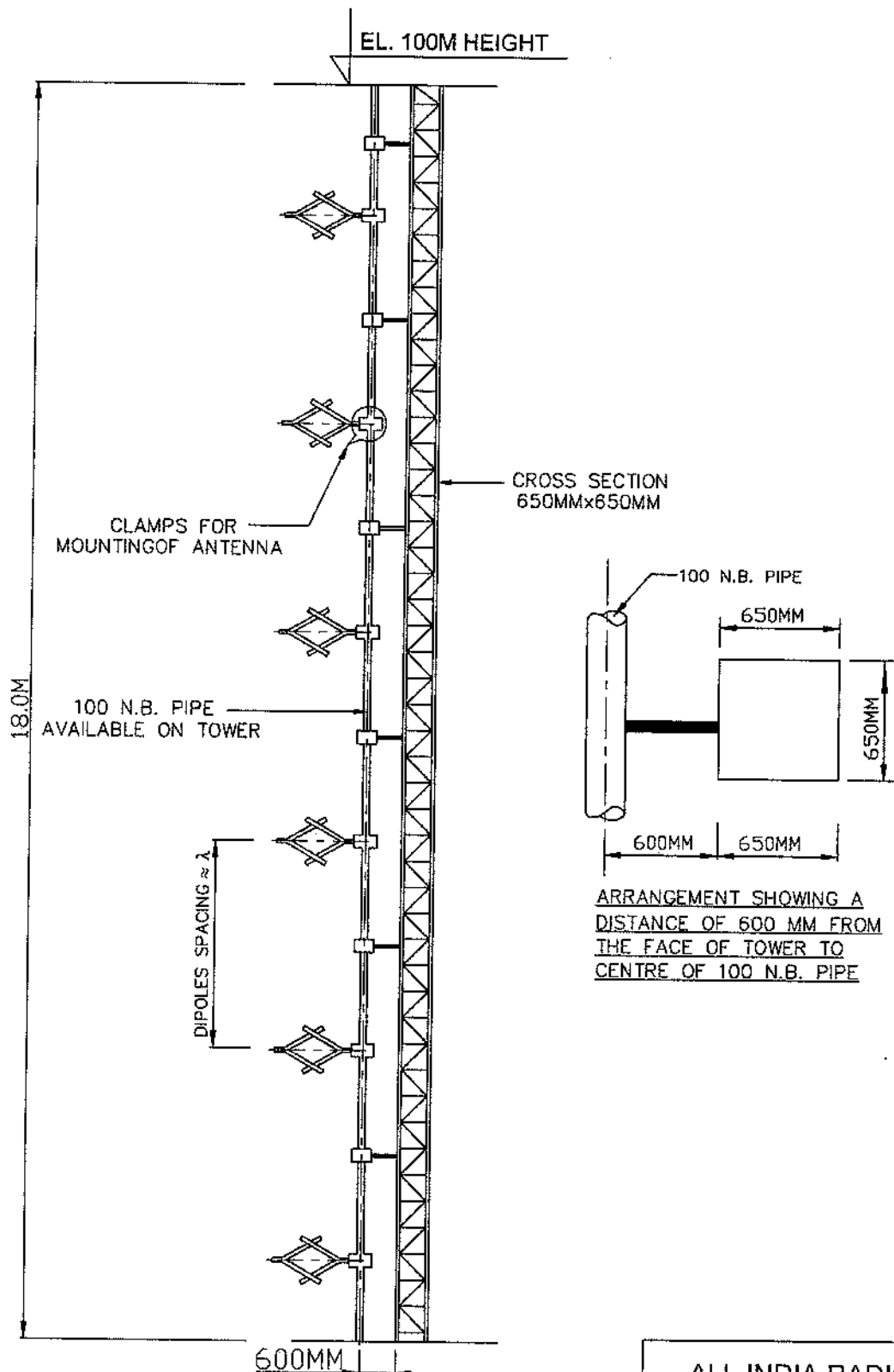
1. ALL DIMENSIONS AND LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
2. DIRECTION OF TOWER FACE FOR MOUNTING FM ANTENNA WILL BE GIVEN LATER ON.
3. FREE FALL PREVENTION SYSTEM TO BE PROVIDED.

MOUNTING ARRANGEMENT OF FM SIDE MOUNT ANTENNA ON TOWER

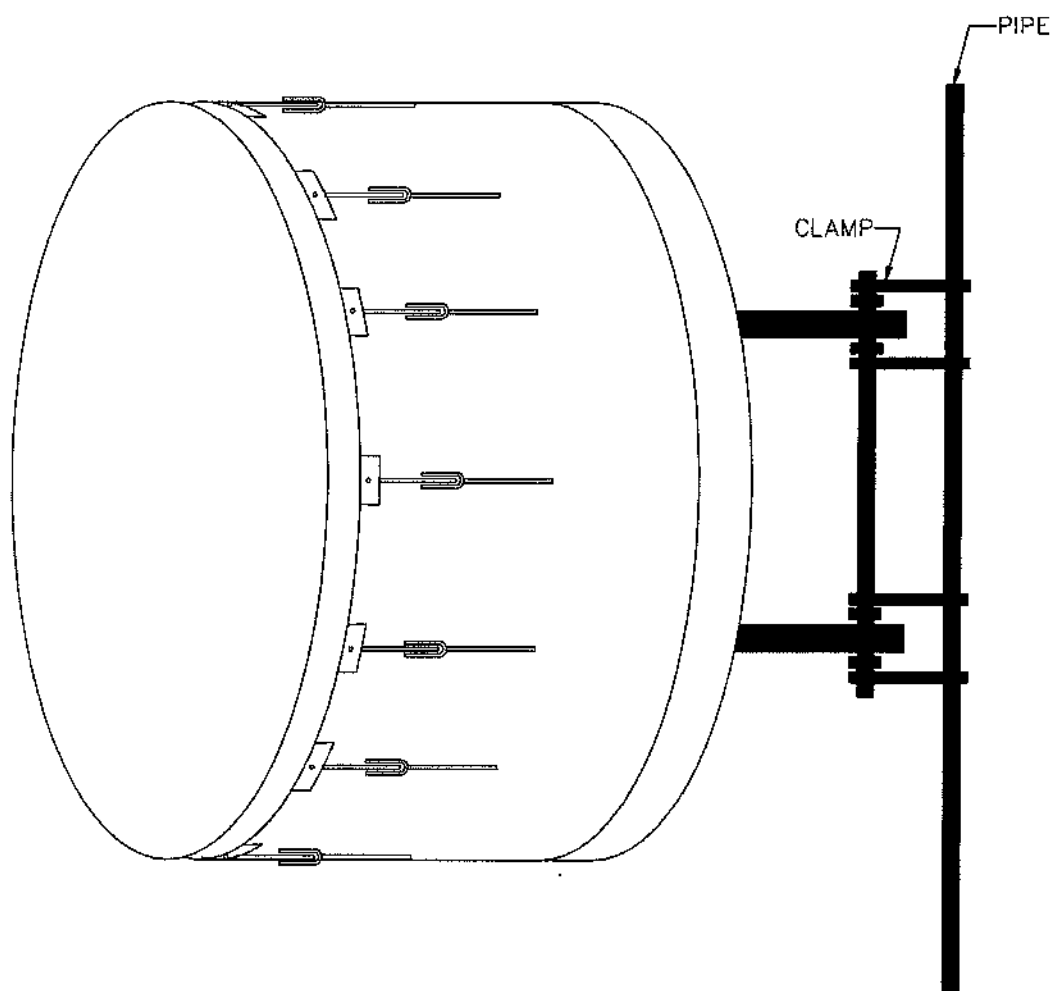
ANNEXURE-VI

(FOR REFERENCE ONLY)

SCALE: - N.T.S.

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ANNEXURE-IV



1.8 M MICROWAVE ANTENNA

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P & D UNIT

4/10

Sandeep
Ravi Kumar/Satyendra Kumar
DDG (FM/SW/MW TR DESIGN)(RG), DDGE (TRANSMITTER DESIGN)

M

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NO. TM-16640

NOTES:-

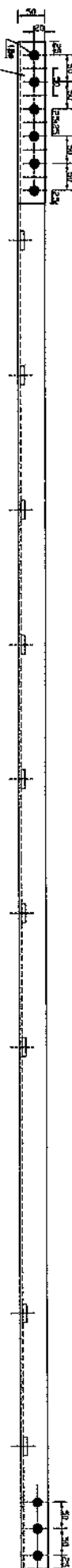
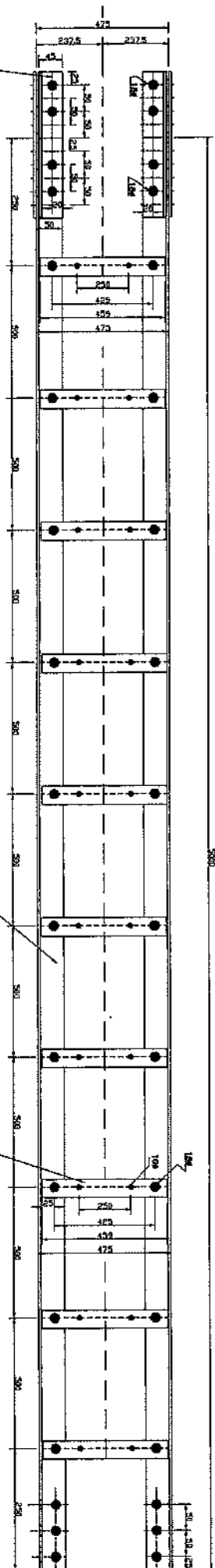
1. THIS DRG. IS FOR REFERENCE ONLY.
2. ALL DIMENSIONS ARE IN MM.
3. GENERAL TOLERANCE: ± 2 MM.
4. INTER AXIS TOLERANCE: ± 1 MM.

CONNECTING ANGLE (ON UPPER SIDE)
 MATERIAL: STRUCTURAL STEEL, ANGLE SIZE: 45X50X5mm THICK, L=300mm.
 CHANNEL THE CORNER ALONG THE LENGTH TO MATCH WITH THE INNER RADIUS OF SIDE ANGLES.
 FINISH: HOT DIP GALVANIZED, DO=400GMS
 QTY = 2 Nos. PER SET

SIDE ANGLE
 MATERIAL: STRUCTURAL STEEL, ANGLE SIZE: 50X50X5mm THICK, L=300mm.
 FINISH: HOT DIP GALVANIZED, DO=400GMS
 QTY = 2 Nos. PER SET

SPACE PLATE
 MATERIAL: STRUCTURAL STEEL, PLATE SIZE: 200X300X5mm THICK, L=300mm.
 FINISH: HOT DIP GALVANIZED, DO=400GMS, ON EACH MAIN PLATE, 20 STROKE.
 QTY = 10 Nos. PER SET

CONNECTING PLATE (ON UPPER SIDE)
 MATERIAL: STRUCTURAL STEEL, PLATE SIZE: 45X50X5mm THICK, L=300mm.
 CHANNEL THE CORNER ALONG THE LENGTH TO MATCH WITH THE INNER RADIUS OF SIDE ANGLES.
 FINISH: HOT DIP GALVANIZED, DO=400GMS
 QTY = 4 Nos. PER SET



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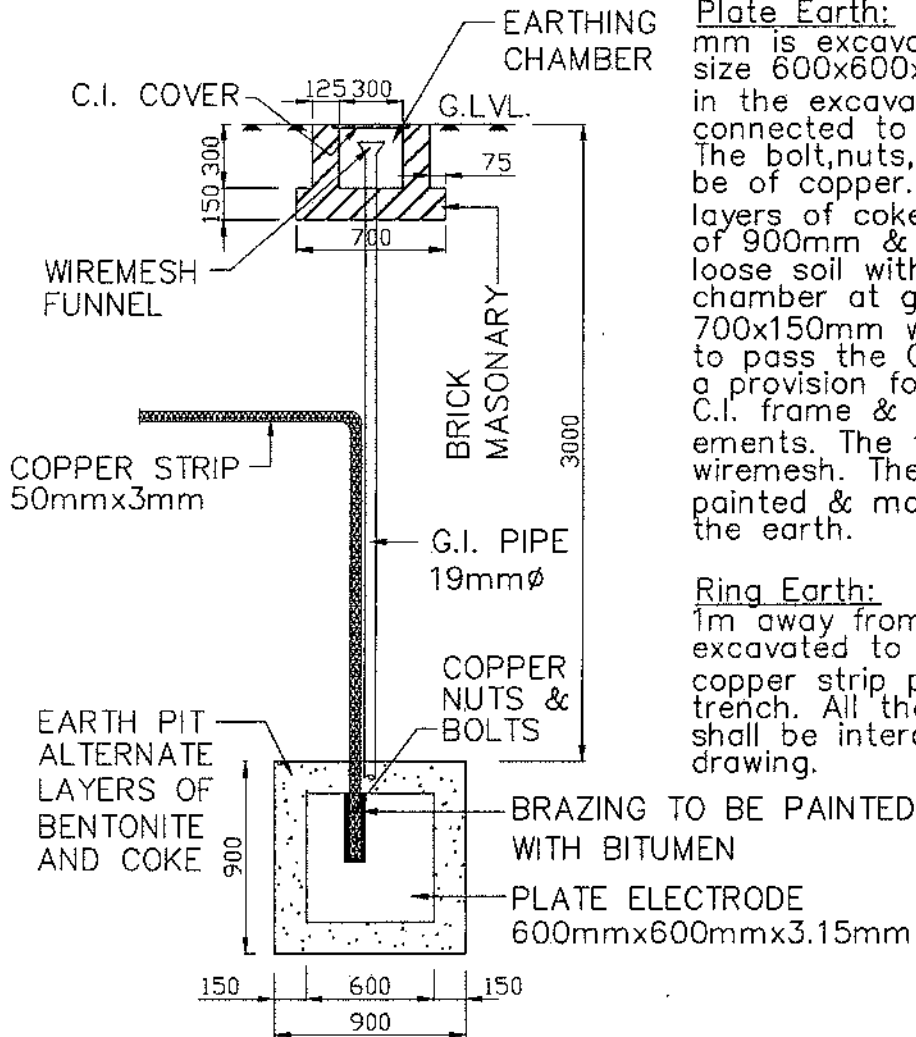
DATE		NAME		GENERAL	ALL INDIA RADIO PAD UNIT NEW DELHI, INDIA
MAR - 18		HAASRA			
DRG	1/80			DETAILS OF VERTICAL CABLE TRAY	
REV					
BY					
CHKD					
C.A.					
SCALE:-		M.T.S.			
AF		D/E		APPROVED:-	NO. TM-16640

S. NO.	DATE	BRIEF RECORD	INITIAL

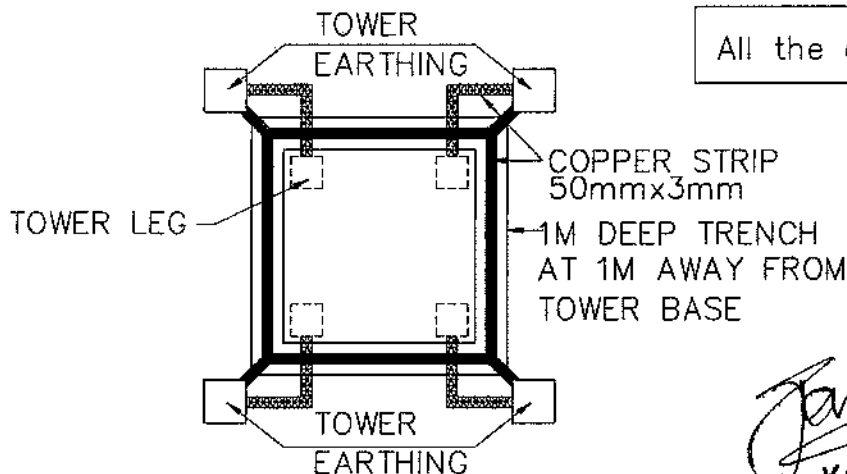
(SUGGESTIVE DRAWING)**PLATE EARTHING****NOTES:-**

Plate Earth: Pit size of 900x900x3900 mm is excavated & copper plate of size 600x600x3.15mm is placed vertically in the excavated pit. The plate shall be connected to copper strip of 50x3mm. The bolt, nuts, check nuts & washers shall be of copper. The pit is filled with alternate layers of coke & bentonite up to a depth of 900mm & remaining portion filled with loose soil without stones. The masonry chamber at ground level of size 700x700x150mm with a hole in the middle to pass the G.I. pipe of 19mm dia with a provision for funnel & provided with C.I. frame & cover with locking arrangements. The funnel shall be fixed with wiremesh. The main hole cover shall be painted & marked with resistance of the earth.

Ring Earth: The trench all-around at 1m away from the tower base shall be excavated to a depth of 1m. 50x3mm copper strip placed at the bottom of the trench. All the copper earth electrodes shall be interconnected as shown in the drawing.

**RING EARTHING**

All the dimensions are in millimeters.

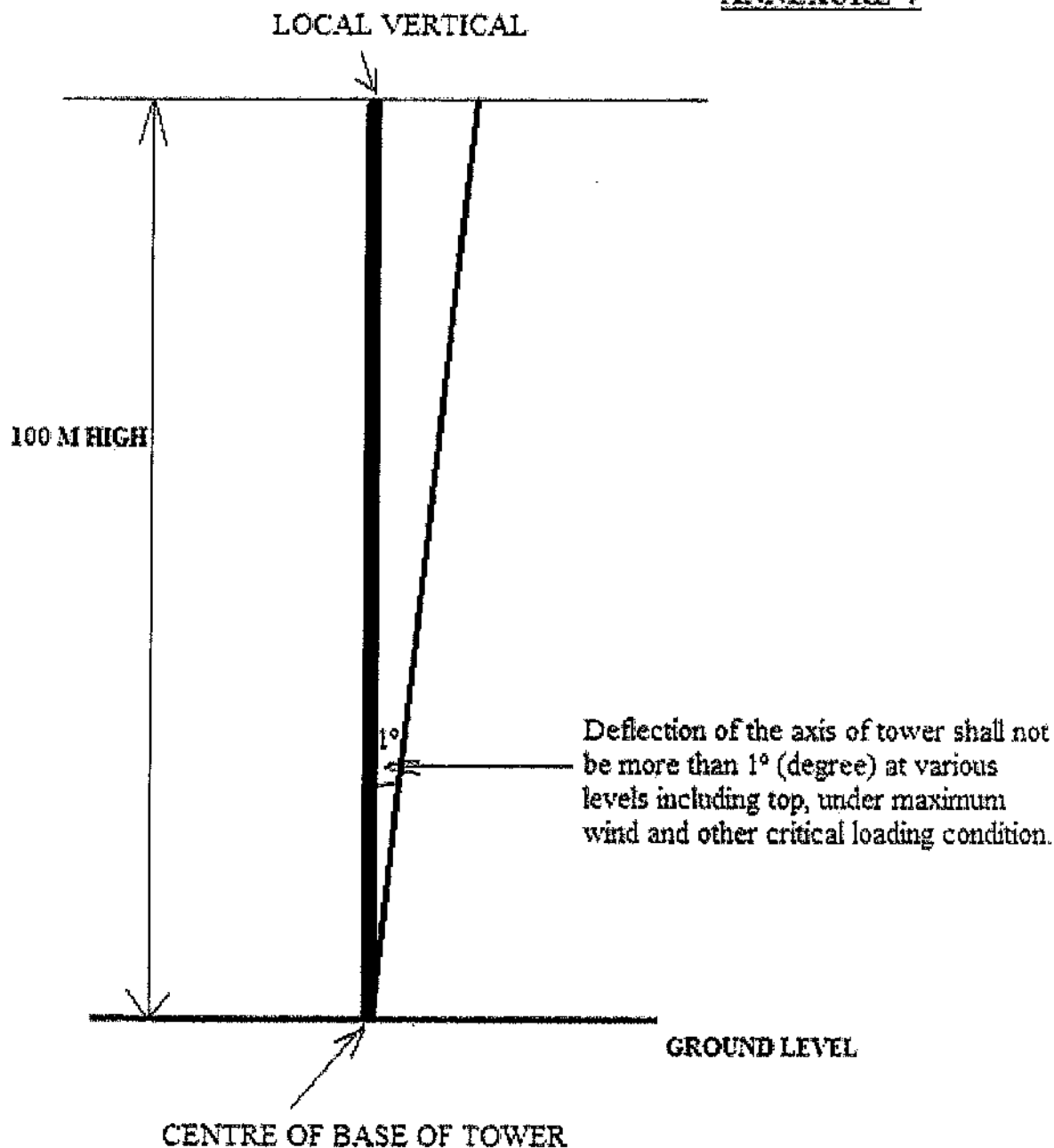


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ANNEXURE-V**SKETCH SHOWING DEFLECTION OF THE AXIS OF TOWER (FOR REFERENCE ONLY)**h/o
21/0

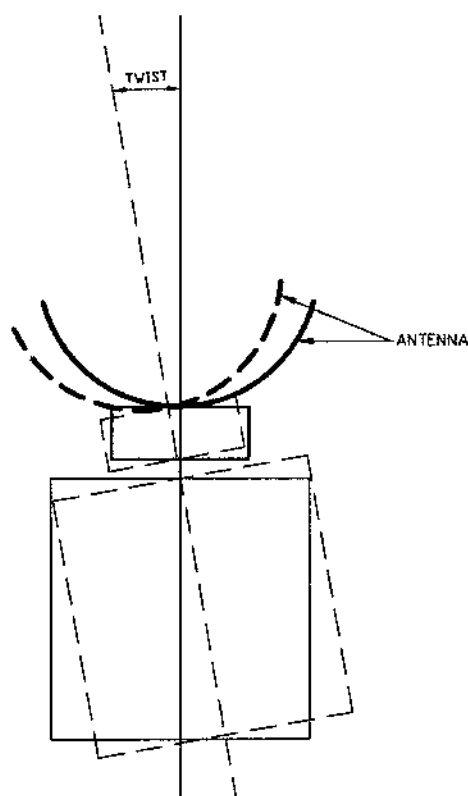
Sandeep

M

Raj

~~Dr. Kamal Jain~~
 Dr. Kamal Jain (CPL)/DDG (Engg.)

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DIAGRAM EXPLAINING TWIST IN TOWERTOP VIEW OF TOWER

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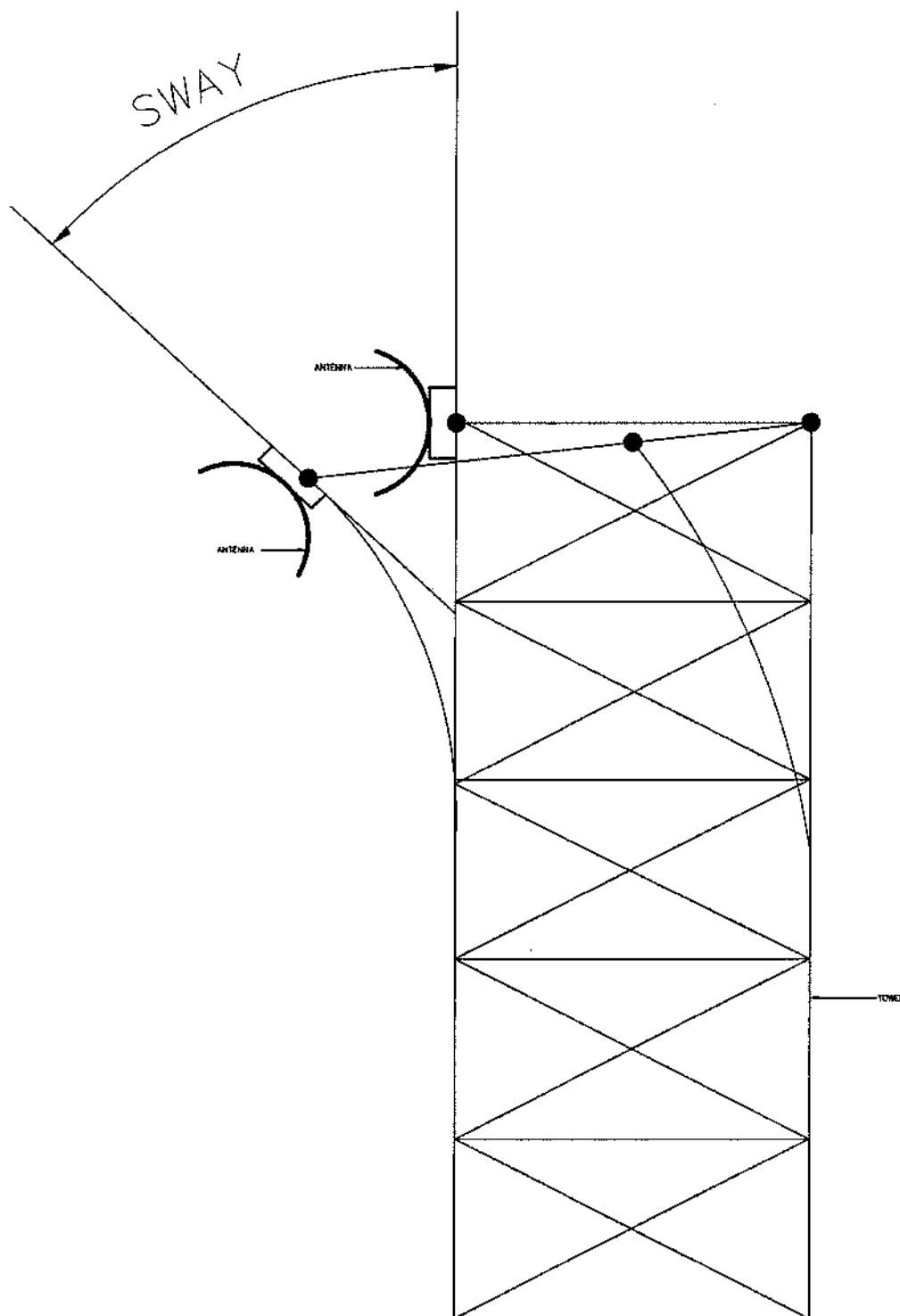
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[Signature]
Sandesh

[Signature]
Sandeep Kumar
DDG (Engg.)

DIAGRAM EXPLAINING SWAY IN TOWER

ANNEXURE-VIII



SIDE VIEW OF TOWER

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Sandeep