



**PRASAR BHARATI  
DIRECTORATE GENERAL : ALL INDIA RADIO  
PLANNING & DEVELOPMENT UNIT**

**SPECIFICATION DOCUMENT FOR 10 KW SOLID STATE  
AMPLITUDE MODULATED MEDIUM WAVE MOBILE TRANSMITTER**

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**N.B:** 1. The tenderer should go through all the sections of these specifications carefully and should confirm clause-by-clause compliance of all the sections clearly. Tenders received without clause by clause compliance are liable to be rejected.

2. Make and Model of each equipment should be spelt out clearly in tender with it's compliance statement signed by OEM alongwith Data Sheet.

3. The tenderer should indicate the items offered as per schedule of requirements, Section-IV, without cost details in technical bid to assess the completeness of offer against AIR's requirement.

**(R K SAINI)  
DY. DIRECTOR ENGINEERING**

**SECTION – I**  
**GENERAL CONDITIONS OF TENDER / CONTRACT**

**General Scope:**

The specifications covers Supply, design & integration of frequency agile 10 KW/ MW DRM compatible solid state transmitter along with all accessories installed in a air conditioned 20' ISO container as well as other requisite separate accessories as for use anywhere in India as mobile station/transmitter set up.

**1.1: Broad scope of supplies/ services:**

**(a) Items to be included:**

- (i) 10 kW Solid State MW Transmitter installed in air conditioned 20' long ISO container.
- (ii) 50 KVA LT Automatic voltage regulator
- (iii) Dummy load.
- (iv) Antenna/Dummy load RF change over switch.
- (v) 1-5/8" 50 ohm R.F. coaxial cable along with accessories including end connectors
- (vi) Portable 60 meter high Folded Mast with Antenna tuning unit and ground screen
- (vii) Facility for Extended / Remote Control & monitoring facility ( OPTIONAL)
- (viii) Wired up programme input rack with equipments installed in container
- (ix) Programme feeding arrangement with RN/DTH etc
- (x) Misc Installation and integration materials for the entire system
- (xi) Self contained silent type 62.5 KVA Diesel Generator set with AMF panel
- (xiii) Power *supply* Distribution LT panel in container for Tx and other accessories from mains & DG set

**1.2 LANGUAGE AND SYSTEM OF MEASURES:**

All information supplied by the tenderer and all markings, notes, designations on the drawings and associated write-ups etc. shall be in the "English" language.

All dimensions and units on drawings and all references to weights, measures and quantities shall be in "Metric" Units.

**1.3. DOCUMENTS TO BE SUPPLIED ALONGWITH TENDER:**

The tender and associated information shall be submitted in duplicate.

Following information shall be furnished to enable AIR to adjudge the full merit of the offer.

- 1.3.1. Compliance statement on each and every clause of these specifications (in the order in which they appear in these specifications) indicating clearly whether or not the equipment and accessories offered conforms to these specifications.  
*Tenders without clause by clause compliance to these specifications is liable to be rejected.*
- 1.3.2. All documents like pamphlets, data sheets, write-ups, drawings, block schematic etc. for the transmitter accessories and auxiliaries etc. in support of compliance statement will be furnished in printed form.
- 1.3.3. Descriptive functional information giving complete details and salient features of the transmitter.
- 1.3.4. Detailed typical layout plan clearly indicating dimensions for main transmitting equipment and its accessories like power supply equipment.
- 1.3.5. An overall schematic of the transmitter circuitry, including the power supply distribution.
- 1.3.6. A comprehensive schedule of materials offered along with quantity of each item.
- 1.3.7. Details of the internal test procedures/standards followed for quality control of the equipment offered and to supply a copy of ISO 9001-2000 certificate .
- 1.3.8. A general undertaking to accept / furnish the guarantees, which will be required to be complied by the contractor as listed under Clause 1.10. of Section- I.
- 1.3.9. A supply record giving the names of the customers, countries, locations, year of supply at site, type

and other details of the similar type of 10 kW transmitter supplied by the tenderer during last five years.

1.3.10 A complete set of performance figures taken on the similar type and make transmitter (at full as well as reduced power specified under Section-III) offered by the manufacturer to be furnished along with the tender.

1.3.11 Any other information, which the tenderer feels relevant to his offer.

#### 1.4 DOCUMENTS TO BE SUPPLIED AFTER PLACEMENT OF ORDER/ ACCEPTANCE OF TENDER :

1.4.1 The following documents in duplicate in hard copies as well as CD form for approval shall be supplied within two months of the date of acceptance of the tender to the Director Engineering (Transmitter Design Section), P&D Unit, DG: AIR, New Delhi-110 001.

- a) Detailed procedure along with drawings in plan, elevation, section and photographs, for the assembly/ installation of the transmitting equipment. (Installation Manual and drawings)
- b) Detailed procedural steps required for various adjustments, settings along with schematic and drawings of the transmitter circuits and all the ancillary equipments, as deemed essential for the testing and commissioning ( Testing and Commissioning Manual) .
- c) Draft "Inspection and Acceptance Test Procedure" (ATP) as per guidelines given in Annexure-I for approval by AIR. This ATP after mutual acceptance will form the basis for final Inspection and testing at works as part of pre-dispatch inspection.

1.4.2 One set each of the above mentioned documents after updating as per approval of AIR shall be supplied to the Director Engineering (Transmitter Design), P&D Unit, DG: AIR, New Delhi-110 001 and concerned Zonal Chief Engineer (Project), and to Installations Officer at site (Total 3 sets per transmitter.)

1.4.3 Above requirement shall not be linked to supply schedule of Equipments.

#### 1.5 DOCUMENTS TO PRECEDE DISPATCH OF TRANSMITTER AND OTHER SUB SYSTEMS :

The following documents shall be supplied, one month prior to the dispatch of equipment. One set of these shall be sent to Director Engineering (TD), P&D Unit, Akashvani Bhavan, New Delhi, one set each to the respective Zonal Chief Engineer and one set to the consignee.

- a) Detailed list of equipment under dispatch vis-a-vis reference of supply order.
- b) Drawings showing location of various components indicating their part numbers in the various units/sub assemblies.

#### 1.6 DOCUMENTS TO BE SUPPLIED ALONG WITH THE TRANSMITTER AND OTHER SUB-SYSTEMS:

1.6.1 Along with each equipment following documents shall be supplied.

- a) Technical Manuals covering detailed circuit descriptions, schematic/circuit drawings for operation & maintenance, in printed form as well as CD form.
- b) Technical Manuals for fault location and Troubleshooting of all the main as well as ancillary equipment in printed form as well as CD form.

1.6.2 a) Test Reports of each sub-system of transmitter and ancillary equipment and the measurements conducted during Pre dispatch Inspection of these equipment at the manufacturer's works signed by their OEM shall form a part of these manuals.

b) These manuals shall include Data-Sheets on various Semi-conductors, Active Devices, Electrical Switch gear etc. used in the equipment supplied.

1.6.3 Three sets each of the above [one set for Transmitter Design Section, one set for Maintenance Wing and one set for STI(T)] shall be packed separately and supplied to the Director Engineering (TD) P&D Unit, Directorate General, All India Radio, New Delhi. One set each shall be supplied to Zonal Chief Engineer (Projects), Zonal Chief Engineer (Maintenance), and two set each shall be supplied to the consignee. (Total 7 sets per transmitter).

#### 1.7 DELIVERY OF EQUIPMENT:

The delivery of the entire equipment (at AIR's transmitter site) shall be completed within 12

(twelve) months from the placement of order.

## 1.8 PACKING & MARKING DETAILS :

Please refer to the relevant para in the booklet "Instruction to bidders"

## 1.9 INSURANCE AGAINST WAR AND MARINE RISK:

Please refer to Commercial terms for transportation by Sea and Land upto site.

## 1.10 COMPLETENESS OF SUPPLIES, QUALITY & WORKMANSHIP OF MATERIAL USED, WARRANTY AND GUARANTEE:

An undertaking to accept the following terms and conditions along with those contained in para 8, P-49 of "Instruction to bidders" (with the exception of para 8.2.2) shall be submitted along with tender :-

### 1.10.1 Correctness, completeness shortages and damages of stores:

- (a) The stores will be complete in every respect with mountings, fittings, fixtures and standard accessories which are normally supplied even though not specifically mentioned in these specifications. The Contractor shall not be eligible for any additional payment in respect of such mounting, fitting and fixtures and accessories which are needed for safe and efficient operation of the equipment. The Contractor shall be responsible for the completeness of the equipment and for efficient working of the same at site.
- (b) The Contractor shall arrange to replenish/repair all the items reported as shortage/ damages free of cost to AIR and send the same to the ultimate consignee at the earliest, but not later than a period of one month from the date of receipt of such intimation from AIR. Payments for freight, insurance and other incidentals for such items shall be made by the Contractor. AIR shall not pay anything extra on this account.

### 1.10.2 Free replacement of components:

The Contractor shall furnish guarantee to make good, at his own expense, any component which becomes defective within 18 months from the date of receipt of last consignment at site or 12 months from the date of commissioning of the equipment at site, whichever is earlier.

### 1.10.3. Materials & workmanship:

- a) Should any defect be noticed in the design, material and / or workmanship of any equipment, within a period of 18 months from the date of receipt of last consignment at site or within a period of 12 months from the date of commissioning of the equipment, whichever is earlier, it shall be replaced by the supplier free of cost, freight and insurance paid, to the ultimate consignee. All India Radio shall inform the supplier about any defects noticed. On receipt of such intimation, the supplier shall investigate the cause of defects and submit a report within 14 days and arrange rectification/replacement / modification of the defective equipment at AIR site without any cost to All India Radio. All such rectifications / replacements modification of the defective equipment based on report shall be done immediately, within a period not exceeding one month from the date of receipt of information by the supplier at no cost to AIR. If the supplier fails to take proper corrective action to repair/ replace the defective item/items satisfactorily within the period of one month as stated above, All India Radio shall be free to take such corrective action as may be deemed necessary, after giving notice to the supplier, at the risk and cost of the supplier. This supercedes para 8.2.2. of "instruction to bidders"
- b) The supplier / manufacturer shall submit an undertaking for supply of spare parts, for a period of ten years from date of commissioning.

c) The manufacturer of transmitter shall ensure that components used (like VVC, transducers, semiconductors, MOSFETS) as well as critical items, are available from more than one source. The information on various sources will be supplied along with the tender. This is to be furnished by OEM.

d) If at any stage during next 10 years from the date of commissioning, the manufacturer stops production of this model of transmitter or any of the spare parts, the supplier is required to submit an undertaking for giving an adequate advance notice to AIR so that the latter can procure, if necessary, the balance of the life time requirements of these spare parts and the critical items.

e) The Contractor shall insure his men while working at AIR site, against any accidental injury death etc. Similarly the equipment, instruments, tools etc., belonging to the Tenderer shall be insured against damage, loss, theft etc. AIR will not be responsible in any way for the safety and security of the Contractor's Men and equipment etc.

f) The supplier shall ensure safety of AIR's Inspectors/ Trainees, while on Inspection and Training (vide paras 1.11 and 1.12 of Section-I of these specifications) at the manufacturer's works, against any accidental injury, accidents, death etc, at no cost to AIR.

g) In case the equipment falls short of the guaranteed performance level, All India Radio will be free to either reject the equipment completely or impose penalty on the supplier so as to recover the cost of the deficiency. However this does not entitle the supplier to deliberately supply substandard equipment or conceal the defects of the equipment supplied by the supplier.

## 1.11 INSPECTION/ ACCEPTANCE:

### 1.11.1 Pre-dispatch Inspection / Acceptance Tests at manufacturer's Works:

a) AIR will carry out the inspection of the equipment ordered at Manufacturer's works, by deputing AIR Engineers, as per mutually agreed Acceptance Test Procedure (ATP). The various tests to be performed and the measurements to be done will be to check the conformity of the equipment offered to these specifications and the various conditions of the A/T.

b) 1st set of Transmitter with all its accessories out of total lot offered for inspection shall be tested at five frequencies (one frequency in each sub band between 502-1605 khz) including the frequency on which it will be delivered by testing in the last. The remaining transmitters set shall be tested at one frequency only which shall be intimated.

c) The contractor shall give at least 8 (eight) weeks notice, to AIR to carry-out the inspection, before the consignment is ready for dispatch.

d) The manufacturer shall put up the transmitter equipment on the test bench, at his premises, before AIR's Representatives and shall provide, without any extra charge, than that indicated in 1.11.1 (g), the power supply, consumable materials, tools, testing instruments and labor etc. as considered necessary for the tests to be carried out, at the manufacturer's premises.

e) The equipment shall be tested at the Mains Input Voltage and frequency specified against the various equipment in Section - III.

f) The inspection and testing period for 1st transmitter (along with accessories) at the manufacturer's works shall be 5 (Five) working days and there after 2 days per transmitter for remaining.

g) The tenderer shall furnish the testing charges, if any, levied by the manufacturer / tenderer (The expenditure towards To & fro Air Journey, lodging, boarding & DA of the inspecting Officers as per Govt. of India norms shall be borne by AIR).

### 1.11.2 Inspection/Acceptance Tests at AIR site (In India):

AIR will carry-out the following inspections/tests at AIR site, in India.

- a) Physical inspection, after receipt of the equipment at AIR site, for reporting any shortages or damages for free replacements / repairs by the manufacturer/contractor.
- b) Testing of equipment after its' installation and commissioning as per mutually agreed ATP to confirm the performance of the equipment to Contract specifications, before finally taking-over/accepting the equipment.
- c) If any component fails or found defective on receipt at site as well during the

installation/testing/commissioning these will be supplied free of cost to AIR site by the manufacturer / contractor. The Contractor will be bound to make free replacements even if the transmitter is commissioned by AIR as per the testing / commissioning procedure specified by the contractor/ manufacturer.

- d) After installation of the equipment at AIR site, in case the performance of the equipment is not achieved as per these specification, the Contractor will be bound to send his representative to solve the problem at no extra cost to AIR.
- e) A heat run test for a continuous period of 24 hours with rated carrier power and modulation as per the ATP shall be done keeping in view the modulation capability specified in the specifications and as per the claims made by the tenderer. Should this test get interrupted for any reason connected with the failure of any component or power failure, for a period exceeding 20 minutes a further period of 24 hours must be commenced. In essence, AIR has to be satisfied that the equipment supplied is capable of operating continuously for a period of 24 hours. This will include the diesel generator at full load.
- f) Any other tests which may be found necessary to prove the performance of the equipment as a result of the preceding tests or as a result of the inspection by the inspecting authority.

#### 1.12 TRAINING OF AIR ENGINEERS:

##### 1.12.1 At Manufacturer's Works: (OPTIONAL)

- (a) The contractor shall be required to train six (6) AIR Engineers. for a period of 1 week at manufacturer's works to enable them to become acquainted with all particulars in respect of erection, testing/ commissioning, operation, maintenance, trouble shooting of the complete transmitter equipment . This training shall be imparted on same type of transmitter including accessories.
- (b) The training programme will be structured so as to cover theory of operation of transmitter, installation, maintenance, practical demonstrations of circuits, maintenance demonstrations, fault finding, testing, commissioning, operation, circuit tracing exercises and major part replacements.
- (c) The tenderer shall quote separately for the Training charges, if any, levied by the manufacturer / tenderer in the tender. (The expenditure towards to & fro Air Journey, lodging, boarding & DA for the trainees as per Govt. of India norms shall be borne by AIR.)

#### 1.13 INSTALLATION, TESTING AND COMMISSIONING:

The transmitter system will be integrated & installed in accordance with the instructions, drawings and other details supplied by the manufacturer . All India Radio shall have the option to carry-out the testing, commissioning and the acceptance tests on the transmitter equipment at site themselves or to entrust the same to the contractor. If the testing/commissioning is done by the contractor, the terms for the same will have to be mutually agreed upon in advance. Testing/commissioning charges shall be quoted separately and will also include the various terms and conditions stipulated by the contractor for the testing / commissioning work along with the time period required for this work.

#### 1.14 AFTER-SALES SUPPORT:

The Manufacturer/contractor shall guarantee for the after-sales support for all the equipment offered under the contract for a minimum period of 10 years, after commissioning of the equipment.

The details of the type of after-sales support and list of the various after-sales support centers in India and elsewhere shall be indicated in the tender.

## SECTION - II DESIGN FEATURES OF THE EQUIPMENT

### 2.0 10 kW MW Transmitter:

#### Type & Configuration:

10 kW. MW frequency agile transmitter fully solid state of field proven technology with MOSFETs delivering full carrier power shall operate on any frequency in MW band with all accessories fitted in 20 feet fully air conditioner ISO container which can be easily transported anywhere in India as per requirement of organization.

Transmitter and its all associated equipments shall be integrated as an entity in 20 feet ISO container with

ventilation and air conditioning system to work as mobile transmitting station having seating and living area facilities for operating engineers and care taking staff.

## 2.1 Design Features

### 2.1.1 General:

- a) The architecture of the Transmitter should be simple and all the devices ergonomically placed for fatigue- less operation, ease in identification of components, adequate accessibility for maintenance / repair/ replacement.
- b) The transmitter shall be capable of continuous operation ( 24x7 Hrs).
- c) The transmitter will be in modular design with plug in modules for easy and quick replacement.
- d) The design shall be optimized to minimize the MTTR and maximize the MTBF. (Typical figures to be given)
- e) The operating sequences will be designed in logical steps with proper annunciated and prompted steps for convenience of the operator.
- f) Supervisory, monitoring and fault diagnostic system should be user friendly & placed ergonomically for the ease in troubleshooting.
- g) An efficient air cooling system shall be provided to dissipate the heat generated wherever required for ensuring safe operation and long life of the transmitter components.
- h) The transmitter shall conform to latest standards for Electrical Safety, Electromagnetic compatibility and Interference.
- i) Drawings: Station wiring drawing showing electrical interconnection between each system of transmitter plant shall be part of manual.
- j) Manual: For each equipment system of transmitter plant manuals shall be provided. This will include manual for operation, maintenance, troubleshooting, Installation, adjustment, testing and commissioning

### 2.1.2 Constructional Features:

#### 2.1.2.2 Transmitter:

Various components and sub-assemblies of the transmitter shall be housed in a rugged mechanical enclosure to withstand impacts, vibrations or abrasions encountered during the transportation, installation, and maintenance of the equipment.

- a) Proper arrangements shall be provided for fixing/grouting of the enclosures/components. The mounting arrangements for the various components / sub- assemblies shall be designed taking care of their weight and to withstand transit / transportation hazards.
- b) The Layout of the components shall be as per technical standards to have sufficient space for carrying out the repair and maintenance in the field.
- c) The material used shall be non- inflammable and fire proof / retardant.
- d) The various metal parts shall be painted to prevent rusting or corrosion. The transmitter panels shall be painted in non-glossy, mat finish color.
- e) The various assemblies and components shall be labeled liberally for easy identification.
- f) Electrical Wiring : Various wires/cables switches etc. used in the equipment shall be as per international standard. Their termination shall be done as per the standard practice used for Broadcast equipment. The various cables and terminations will be ferule numbered with cross-reference in circuit diagrams / drawings for ease in identification. Provision for cable entry shall be kept from top as well as bottom. All the wiring shall be routed through cable troughs duly harnessed and fastened. Suitable provision for preventing the entry of rodents through left over Cable entry routes is to be made.
- g) Size: The size of the equipment will be optimized for economy in space required for installation and convenience of maintenance. Typical equipment layout drawings showing the shape and size of the various equipment in plan and elevation shall be enclosed with the offer.
- h) Weight : The weight of the equipment shall be optimized to have the required ruggedness and ease in handling. The weight of various equipment shall be specified in the tender.

2.1.3 R.F. SECTION : RF Section shall consist of three stages namely RF source, driver/ buffer/ distribution amplifier and Power amplifier consisting of multiple RF modules followed by combiner,

## Filter & matching network.

- 2.1.3.1 R.F. Source: Frequency agile RF Drive Unit having two independent RF sources shall be suitably located in transmitter cubicle having following provisions:
- (a) RF frequency shall be generated by DDS (Direct Digital Synthesis) for having spectral purity in AM band. Both the RF sources should be fully interchangeable. It shall have the provision for selecting the frequency of operation with the help of Push button/decade switches from front panel.
  - (b) Each source shall be self-contained in all respects including arrangement for varying the frequency to a few cycles in field for having stability as per Section - III.
  - (c) Automatic as well as manual change over arrangement shall be provided for selecting the healthy RF Source.
  - (d) Provision for visual indication of active RF source shall be provided.
  - (e) A BNC socket, (50 Ohms ) for monitoring of carrier frequency shall be provided.
  - (f) A 50 Ohm BNC Socket also shall be provided for connecting an external RF source / synthesizer.
- 2.1.3.2 R.F. Buffer/Driver/ Distribution Amplifiers: This unit shall be self-contained having 100% redundancy, and broadband with no frequency selective components for splitting the RF feed to PA Modules. The tenderer shall furnish complete details with schematic diagram to assess the specified provision.
- 2.1.3.3 Design Criteria of P.A. Modules : The transmitter power block shall have multiple R.F. P.A Modules of identical design and completely interchangeable and capable of delivering 10% higher output than it's rated power with 100 % modulation at nominal supply voltage. PA modules shall be wired in suitable combination for plug-in connection/disconnection for ease in maintenance. The P.A. Modules shall be based on MOSFETs with adequate safety margins to work under extreme ambient conditions in tropical regions as specified under Section – III. PA Module shall be broad band (in MF band) without any tuning elements / frequency dependent components.
- (b) Arrangement of P.A. Modules: A number of R.F. PA Modules shall be wired in series/parallel, combinations to provide required rated power output. Detailed configuration of RF modules along with the type of combiner used shall be given.
  - (c) Protection of P.A/Modules : Effective and adequate arrangements will be provided for protection of P.A. modules against the risk of failure due to:
    - i. Excessive Heating;
    - ii. Voltage Surges/Spikes.
    - iii. Load Mismatch/High VSWRs with automatic power fold back as specified in Section III
    - iv. Excessive Load Currents/Short Circuits/ Sparks
    - v. Lightning/Static
  - (d) Isolation of defective PA modules: Arrangements shall be provided for isolation of the defective PA modules to prevent deterioration of technical performance of the transmitter.
  - (e) Information to be submitted with the tender :
    - i) Total no. of P.A. Modules used in the transmitter required for 10 KW carrier power with 10% overrating at 100% modulation.
    - ii) Minimum No. of P.A. Modules required for 100% Modulation at rated carrier power .
    - iii) Maximum number of modules which can fail without affecting the broadcast service
    - iv) Whether any balancing in corresponding section of PA module for a defective module in other section is required to maintain technical performance? If so details to be provided .
    - v) Peak ,r m s & Average power output of each PA module at full carrier power with 0% and 100 %

- modulation.
- vi) Details of protection devices provided against failure of PA modules, which should include item mentioned in Para 2.1.3.3(c) above.
- vii) Safety margins adopted in the design criteria of the PA modules.
- viii) Circuit Diagram of the P.A Module.
- ix) Make, model and details of supplier for MOSFETs (At least two sources).
- x) Type and details of the arrangements provided for isolation of defective modules.
- xi) Average life of RF Module.
- xii) Efficiency of RF Module.

#### 2.1.3.4 P.A. Combiner / Output Network and Filter:

Being frequency agile transmitter all stages including output network and filter shall cater to entire MF band with suitable selection arrangement.

- (a) Combiner: The mechanical assembly of combiner will be designed for plugged connection/disconnection of PA modules for ease in maintenance. Details of sub/ main combiner are required to be submitted.
- (b) Output Filter: A low pass filter to remove the spikes due to switching in/out of the P.A. Modules shall be provided in the output network.
- (c) Harmonic filter : Necessary tuned circuit / circuits for filtering out unwanted harmonics and undesired spectral components below the limits specified in Section- III shall be provided in output circuit. Details of filter is to be indicated.
- (d) Output Impedance Matching Network : Details of Matching network to obtain an output impedance of the transmitter specified in Section-III as well as isolation from load side disturbances like very high continuous VSWR resulting from any fault in Transmission line, ATU, Mast etc. shall be provided.
- (e) Output Network Protection : The output network of the transmitter should incorporate spark gaps and required VSWR detecting devices for effective protection against :
  - a) High VSWR / Load mismatch (Instantaneous & Long term).
  - b) Sparking/ flash over/ arcing
  - c) Lightning
  - d) High voltage discharge / Static

#### 2.1.4 Modulation Technique:

- (a) Amplitude Modulation shall be generated with digital techniques i.e. PA Modules will be switched ON/OFF in proportion to amplitude of analog input signal.
- (b) Detailed description of modulation technique, the year of its introduction & a list giving numbers of transmitters of 10 kW and higher power using the same modulation technique supplied world-wide during last 5 yrs shall be furnished . The list will include postal address of customers, e-mail & telephone no. and year of delivery. The tenderer shall furnish the details of audio chain and the principle and system of modulation employed ,with schematic/block diagram etc.
- (c) DRM Compatibility : The Transmitter shall be compatible for Digital broadcasting having simulcast facility as per DRM standard. To make transmitter DRM operational, the additional items required are to be quoted in schedule of requirements section-IV as optional item.

#### 2.1.5 Power Supply :

Transmitter shall operate with 400 volts (Phase to Phase) 3 phase 50 Hz power supply connection for feeding to entire transmitter equipment system at the mains input, for normal operation with the power supply variations specified under Section-III. In case of failure of mains the system shall operate with 62.5 KVA diesel generator.

Power supply system (main & sub) shall be regulated and capable to withstand various overloads

including transients encountered during the operation of the transmitter without undue heating of any power supply components as specified in Section-III.

a) Power supply equipments : As there will be a 400 volts, (phase to phase) 3 phase, 50 Hz mains with a captive D/G supply as alternate input provided by AIR for transmitter equipments as specified under Section-III any step down or step up transformers and the associated distribution and control switch gear along with necessary protective circuits required for any section and also for any accessory of the transmitter equipment (under scope of the supply of this Tender) shall be supplied by the tenderer as a part of Transmitter power supply equipment.

b) Mains isolation switch : A suitably rated Air Circuit Breaker (ACB) or equivalent will be provided for isolation of mains input to the transmitter.

c) Emergency off : A Push Button (Red in color) shall be mounted on the front panel of the transmitter to isolate the Mains supply to the Transmitter in case of any Emergency.

d) Transient Protection: Metal Oxide Varistors (MOVs) or similar fast acting devices will be provided at the input of Power Supply system of the Transmitter and all sub system to protect the equipment from voltage surges/transients encountered on the mains input line as specified under Section-III.

#### 2.1.6 TRANSMITTER CONTROL SYSTEM:

The Transmitter control system will be designed using user friendly digital control techniques. Control system shall be having self diagnostic, supervising & monitoring facilities along with visual display as well as re-settable aural alarm.

i) Switching Sequence & Interlocking: The "Switching-ON" and "Switching-OFF" of the transmitter will be interlocked to ensure the desired operational sequence for the safety of the equipment and operating personnel. The transmitter output power shall also be interlocked with dummy load and Antenna change over switch.

ii) Control and Indications : Following visual indications on the status of the transmitter will be provided in the Local and Remote mode ( Tx. Front Panel):

- a) Transmitter-on/off
- b) Power level
- c) Local/remote mode of operation
- d) Forward Power, Reverse Power
- e) Fault
- f) Oscillator status

All faults shall be supplemented with reset-able audible alarm.

iii) Fault Diagnostics: Indications as required and procedures will be provided for fault diagnostics in the various circuits of the transmitter up to module level.

iv) Metering: Necessary metering will be provided to have a close monitoring of the following vital operating parameters of the transmitter ( in 'Local' and 'Remote' ).

- a) Mains input voltage
- b) Stage DC Voltages
- c) Stage DC load currents
- d) Audio input level /percentage modulation.
- e) Forward RF power
- f) Reverse RF power
- g) Transmission hours.

#### 2.1.7 Protection of equipment and operating personnel:

i) Safety of operating personnel : Adequate and fool-proof arrangements shall be provided for protection of the operating personnel against hazards of any nature involved in operation and maintenance of the equipment covered under this specification as per IEC 215.

- ii) The Operating Personnel shall be protected against following hazards by providing suitable interlocking through door key inter-locks, ground hooks or mechanical locks having electrical loops etc. (to be confirmed for provision by enclosing a schematic indicating type of device)
  - a) Against high RF voltages;
  - b) High voltage Power Supplies;
  - c) Energy storing components requiring discharge time
  - d) Access to moving machinery, hot / live components.
- iii) Protection of components: The Equipment and its various components will be protected by providing suitable devices like arc gaps, corona rings (to be confirmed for provision indicating type of device and their locations) against the following:
  - a) Electrical Flash over ;
  - b) Deep Voltage fluctuations/transients;
  - c) Lightning on or near the Antenna
  - d) Fire due to sparking etc.
- iv. EM/ RF Radiations :The radiation shall be within the safe limits prescribed under the relevant standards to avoid risk to operating personnel.
- v. Earthing Rods: Earthing rods wherever required shall be provided.
- vi. Earth terminals: for connecting client's earth to the transmitter shall be provided at appropriate locations as per standard practice.

The above details along with the schematic and location of the various provisions made for protection of equipment and operating personnel shall be indicated in the enclosures with tender.

2.1.8 **Extended/Remote control (Optional) Facility for an Extended/ wired Remote control & monitoring system** having facility for remote ON/OFF , reduced power operation and monitoring of vital parameters, Percentage modulation Meters, logging facility shall be provided.

2.1.9 **Cooling System:**

(i) **Main Features of cooling / Heat extracting arrangement:**

- a. An air cooling system shall be provided to take away the heat generated in the equipment for ensuring a safe operation and long life of the transmitter components.
- b. The air-cooling system shall be designed for both closed and opened (fresh air) circuit operation in conjunction with Air-conditioning unit of container. The tenderer shall include the fans motorized louvers (for closed and open circuit operation), Air ducts), Air Filters/ weatherproof louvers etc. in the offer. Details to be provided in the tender.
- c. The cooling fans / Blower shall be designed for acoustic noise as specified in Section-III to minimize the fatigue to the operator.
- d. **Dust filters:** Fine filters of washable and re-usable type of sufficient surface area shall be provided at the cooling air inlet to container as well as transmitter. Details, size and filtering efficiency of the filters may be furnished in the tender for tropical environments.
- e. Protective devices should be provided to fold back the Power of the transmitter upto a safe operating level in case of insufficient / deficient cooling.

(ii) **Air cooling System features:**

- a. The capacity and static pressure of fan/blower should be as per ventilation requirement of the container in which transmitter and other associated equipments shall be installed. The blower /fan shall be statically & dynamically balanced.
- b. Air filters shall be of synthetic material , non woven washable type with efficiency 90 % down to 10 microns, .
- c. The duct shall be fabricated with standard rust proof sheets suitable with joining collars and

smooth bend.

d. Requisite supports and anti- vibration duct hangers shall be provided.

(iii) Following data shall be supplied with tender.

- a. Detailed schematic of cooling system for transmitter and container system indicating number and capacity of the cooling fans used .
- b. Total amount of heat generated by the transmitter equipment and ancillaries including D/L to be extracted by Air System shall be specified separately.

#### 2.1.10 Input/output connections from Transmitter Cabinet:

The transmitter cubicle shall be designed for connection of the R.F. output from top and for power supply, audio control & other monitoring cables from top as well as bottom of the cubicle.

The following Input / Output Connections will be provided:

i) **Input connections:**

- a) Mains input through suitable industry standard connectors with suitable termination.
- b) Audio input shall be through suitable industry standard connectors.
- c) Remote control connections: The remote control command connections shall be through suitable terminal blocks / standard connectors.

The mating connectors shall be supplied along with the equipment.

ii) **Output connections :**

- a) RF output: RF output shall be terminated suitably for connecting to 1-5/8", 50 ohm RF coaxial cable.
- b) RF o/p for performance measurement: One sample RF output shall be provided by terminating in a BNC connector with output level of 5 to 15 volt RMS, suitable for connecting modulation monitor of standard make which shall be used for performance measurement purposes.
- c) De-modulated output: A demodulated output by providing a suitable detector unit shall be provided/ terminated in a BNC connector with a level of 1 volt RMS for aural monitoring.

#### 2.2 AUTOMATIC VOLTAGE REGULATOR (AVR):

The AVR shall be Servo controlled type with individual phase sensing and control for regulating unbalanced incoming voltage. The AVR shall be housed in a rugged enclosure to withstand the transit hazards and to provide mechanical protection to the sensitive parts and will be provided with wheels for ease of movement. The enclosure shall be designed for indoor operation. An efficient natural cooling arrangement ensuring long life for the AVR shall be provided so that the AVR works without getting unduly heated. The AVR shall be painted in the standard equipment color.

i) The input/output connections shall be provided in covered boxes with cable glands for cable entry from overhead trays/underground trench.

ii) A 4 pole ACB / MCCB of adequate capacity having adjustable over-current and magnetic release and with tripping facility from emergency OFF of the transmitter shall be provided as Mains Isolation Switch to the AVR.

iii) An arrangement to By-pass the AVR shall be provided.

iii) Meters shall be provided for measuring the following:-

- a) Input voltage
- b) Output voltage
- c) Input/Output current

iv) Electrical protection : AVR shall be protected against over loads of both prolonged and short duration including transient's from power supply line.

#### 2.3 DUMMY LOAD:

2.3.1 **Type**: Dummy load shall be of standard make closed circuit air cooled or water - cooled resistance type. All the accessories like Heat Exchanger, Pump, Flow meter, Blower Unit etc. shall be included in the offer.

2.3.2 **RF Input Impedance & connection type**: Impedance shall be as indicated in Section-III. The termination arrangement will be as per internal feeder system.

2.3.3 **RF Power Measurement**: Direct reading type RF Power measurement shall be provided either by electrical method or by Calorimetric method with digital display.

2.3.4 **Electrical/Thermal Protection**: The dummy load shall be protected against over heating, electrical

overloads. Necessary protection shall also be provided for any over loads occurring in any component of the dummy load.

- 2.3.5 **Mechanical construction:** Dummy load enclosure shall be constructed out of sheet metal work with a frame work. The dummy load shall be grouted on the floor. The body of the dummy load shall be provided with a protection paint coating to prevent rusting, corrosion etc.
- 2.3.6 **Electrical input :** The dummy load shall work on mains input voltage specified under Section - III.
- 2.3.7 **Interlocking:** In addition to it's internal interlocking, the dummy load shall be interlocked with the transmitter. The interlock connection shall switch-off the transmitter R.F. Power automatically (in case the transmitter is delivering R.F. Power) or would prevent switching-on of transmitter RF power (in case the transmitter is not delivering R.F. Power) for the following conditions of the Dummy load:
- The R.F. Connection between the Dummy Load and the transmitter is not through.
  - The Dummy Load impedance is outside the permissible variation.
  - The cooling system of the Dummy Load is not functioning properly.
  - There are any overloads or abnormal working conditions of the dummy load.

#### 2.4 RF CHANGE OVER SWITCH:

It shall be manually operated motorized switch for 50 Ohms RF Coaxial cable. For connecting the output of mobile Transmitter and existing standby transmitter to either antenna during normal transmission or to dummy load for testing the transmitter. The switch shall provide the necessary R.F. isolation between the input and output ports and also between two output ports.

The switch shall be housed in a suitable rugged enclosure with proper isolation of live terminals / points. It shall be suitable for overhead mounting but operateable from the ground level with suitable indication provided/extended at the operating point to clearly indicate the position of the switch.. The details of mounting arrangements shall be included in the installation manuals of the transmitter. The enclosure shall be painted/ treated to prevent rusting/corrosion, in a color to match the transmitter equipment.

- Interlocking connections shall be provided from the antenna change over switch, wired into the transmitter controls, so as to ensure that the transmitter RF power can be switched on only when the transmitter is connected either to the antenna or to the dummy load.
- The switch shall be adequately rated for the power handling capacity mentioned under Section-III.
- The switch shall be designed to present a very low VSWR as mentioned under Section-III.

#### 2.6 Feeder Cable, ATU & Mast:

A 60 meter high shunt fed omni directional self radiating portable grounded vertical tower of 20 KW carrier power rating folded type unipole antenna (specifically designed for easy handling during Transportation) complete with erection Kit and associated materials shall be supplied with mobile set up. Antenna shall consist of grounded vertical tower with six folded wires spaced in 60 degrees around the tower. The folds shall be tied together on the ring at base of antenna. Ground screen consisting of 3mm dia 60 nos. 60 mtr. long copper wire equi spaced around the tower, shall be supplied for providing conducting ground around tower.

The ATU shall be designed to match transmitter out put to the antenna input impedance over the whole MW band. All components shall be placed in weather proof Al-box that makes it ready for immediate service ATU shall have provision as per standard broadcast practice.

Flexible 50 ohm RF coaxial cable shall be used as connection between the transmitter and antenna matching unit. The cable shall be provided on a reel drum fitted with suitable RF connector at both end for portability.

#### 2.7 PROGRAMME INPUT EQUIPMENT RACK:

##### 2.7.1 GENERAL :

- A stereo Pre Wired Programme Input Equipment Rack is required to process the programme (analogue audio signal) received from various sources like studio center via Telephone lines or VHF/ Studio Transmitter Link / rebroadcast from satellite receiver, tone from generator before feeding to the transmitter to the required nominal level with professional quality through audio processor.
- It shall be a standard 19" Rack conforming to professional standards of sound broadcasting for mounting equipment and accessories as per configuration indicated later.
- It shall have the facility for monitoring of programme through a Monitoring Amplifier with rack mounted as well as external speakers.
- Six Nos. of Audio Input signals shall be given to the Rack viz. Prog-1, Prog-2, EM.ST., RN, Rx and OSC. DTH. The required input shall be selected using a suitable Program Selector Switch, mounted on the Selector Switch Panel . The selected input shall be applied to the Audio Processor and then to the

Distribution Amplifier. One of the four outputs of the Distribution Amplifier shall be fed to the transmitter. All the four outputs shall be monitored using VU / Program Monitor & a Monitoring Amplifier.

e) RF Samples from the Transmitter shall be given to the RF Patch panel mounted at the rear side of the rack. The RF Sample shall be monitored using the CRO. From the RF patch panel, signal shall also be fed to the AM Modulation Monitor. The demodulated audio signal can be monitored using VU/ Program Monitor & a Monitoring Amplifier. The signal to be monitored shall be selected using a 12-way Selector Switch mounted on the Audio Patch Panel. Programme and monitoring chain shall be brought to an Audio Patch Panel consisting of 48 jacks (24 in each row).

f) Necessary jack field, repeat coils, tag blocks, terminal strips, BNC connectors etc as per requirement shall be provided in the rack for all inputs.

g) Facility to measure/ monitor levels at various points in the programme chain with a VU(PPM) meter and a selector switch shall be provided in the rack.

**2.7.2 Rack Wiring :** All the wiring in the rack shall be carried out with Mil standard approved PTFE insulated, shielded, twin core, audio cables of standard make in PVC cable duct.

- (i) The wiring for all the equipment shall be routed through terminal blocks which shall be suitably located for easy accessibility. All the wiring on the terminal block shall be suitably marked. The wiring bunches shall be neatly laid and clamped to the body of the rack.
- (ii) The low level audio lines shall be suitably isolated from high level audio lines to avoid interference.
- (iii) Power supply wirings shall pass through separate conduits and shall be segregated suitably from the audio wiring in order to avoid noise and hum pick up.

**2.7.2 Other Accessories:**

- (i) A lamp to illuminate when the door is opened shall be provided on one of the side at top.
- (ii) Arrangement may be made for mounting tag-blocks/terminal strips at a height of 450mm from the bottom at the rear side.
- (iii) PVC channels may be provided at the front as well as the rear for routing cables.
- (iv) Necessary shelves/hooks shall be provided for keeping patch cords & headphones.
- (v) A 1U blank space shall be provided for fixing a tone generator.
- (vi) Blank panels of 1U height wherever required for proper gap between equipment are to be provided suitably.

**2.7.3 Power Supply:**

- (i) A single phase 50 Hz., 230 V Mains Panel to distribute power supply with indication lamp and MCB to the various equipment, mounted on front side bottom in the rack shall be provided.
- (ii) RFI Filter to protect against electrical & EM disturbances shall be provided for protection in the mains supply. A Distribution panel with suitable rating fuses for over current protection for each outlet shall be provided at the output of this filter.
- (iii) Power supply to all the equipment/circuits in the rack shall be distributed from this panel along the height of rack at each equipment level. A spare 5A,3 Pin power socket shall also be provided.

**2.7.4 Earthing :**

All the equipment in the Rack shall be properly earthed. The earth terminals of the power supply and audio circuits shall be kept separate and brought out on suitable terminals for earthing.

**2.7.5 Shielding:**

The Rack shall be installed by the side of mobile transmitter. Therefore, necessary precautions shall be taken to shield the equipment and wiring from high level R.F. field, to deliver specified performance of programme input eqpts. Door leaf shall be connected with flexible braided wire to rack body.

**2.7.6 Configuration/layout of equipment:**

The rack shall be having following configuration in ascending order starting from top to bottom with necessary blank panels in between.

- (i) Monitoring speakers
- (ii) VU meter/ PPM with selector switch
- (iii) RF patch panel (on rear of rack)
- (iv) CRO for monitoring AM wave with rack mount kit :
- (v) Modulation monitor :
- (vi) Audio patch panel with programme selector switch, monitoring selector switch and attenuator (rotary

fader) for programme fed to transmitter for reserve gain.

(vii) Jack fields

(viii) Tone generator ( to be supplied by AIR separately)

(ix) Audio processor

(x) Audio distribution amplifier

(xi) Monitoring amplifier

(xii) All Wave satellite receiver – for monitoring and relay programme feeding arrangement

(xiii) Power supply distribution panel (front bottom).

The Tenderer shall prepare schematic drawing including level diagram & layout of equipment in the offered Rack and submit along with tender.

## 2.8 Modulation Monitor:

The Equipment is to be used for measuring the modulation & carrier deviation level of A.M. broadcast transmitters in MW &SW range. The equipment shall be simple in operation requiring no tuning. The instrument shall have efficient R.F. screening so that it can be operated in high R.F. field. It should be precise, compact, fully solid state & rugged. It shall conform to international broadcasting measuring equipment standards in all respects.

The equipment shall have :

1. It shall have modulation level and carrier deviation measurement.
2. Broadband demodulator for providing accurate proof of performance measurements on AM transmitter.
3. Built in calibration for the accuracy of modulation reading.
4. Isolated out puts for modulation and carrier level alarms.
5. Remote out puts for all modulation indication as well as the carrier level.
6. Separate negative and positive peak modulation indications.
7. Peak modulation indicator, range up to 125% for positive modulation with suitable incremental step above 50% .

## 2.9 Cathode Ray Oscilloscope

Oscilloscope shall be rugged and portable with user-friendly front panel controls for various types of measurements quickly and precisely. It shall provide facilities for commonly used automatic Measurements, auto set features, Cursor measurements, etc..

## 2.10 Audio Processor :

The audio processor shall be a part of the analogue audio input chain to AM Transmitters. The equipment should be capable of processing sound in digital domain for producing very bright, clear and punchy sound providing balance between optimum loudness & high quality with substantial improvement in both speech/spoken words and music quality for high modulation and simultaneously offering protection to transmitter also. The equipment should be fully solid state, self-contained, compact, easy to set up, simple to use, efficient for working round-the-clock, 365 days a year and based on field-proven design. The equipment should have:

- (a) A multi-band processor with compressor & limiter function for optimum loudness & high quality
- (b) Built in digital processing having A/D & D/A conversion with minimum of 18 bit resolution.
- (c) Provision for receiver equalization at low, mid and high frequencies
- (d) Provision for final clipper for protection against peak over modulation
- (e) Provision for transmitter equalization
- (f) Front panel controls/metering
- (g) By pass mode ( Features which remain in chain to be indicated by tenderer)
- (h) Should be upgradable to digital input/output in future and select automatically any of the three standard sampling rates of 32, 44.1 and 48 Khz

## 2.11 ISO CONTAINER:

- The container shall be suitable for mounting of transmitter and it's all the accessories including ancillaries as defined elsewhere in the specifications. Latest technology materials should be used for heat and noise insulation of the walls, ceiling and floor operational areas. Recommended size of container shall be approximately L-20' H-8' W-8.
- 2.11.1 The container should be ergonomically designed to have best of the physical and environmental conditions for working personnel as well as traffic/road conditions of the country.
- 2.11.2 The chassis of the container should have load-bearing capacity to withstand the weight of transmitter and all associated equipments, Furniture, Equipment Racks & operating/caretaking Personnel.
- 2.11.3 Chassis of the container should be provided with suitable suspension to absorb any jerks and shocks while on movement. Since the container has to carry a large number of sophisticated and costly equipment, utmost care should be taken while selecting the chassis and designing the body of the container. Therefore container customization shall include all aspects including Structural Analysis, System Design, Coach Building Equipment Installation, and Field Testing. Shock absorbers should be provided on the mounting of equipment wherever necessary so as to avoid them from being damaged during the vehicle movement.
- 2.11.4 . The system shall be designed to allow rapid transportation in the Indian environment, quick and easy deployment.
- 2.11.5 The installed equipment should have easy access to back panels for ease of maintenance. Layout of the Transmitter, Equipments, Racks, Air Conditioning, Power Supply, are to be submitted by bidders along with the bid. The successful bidder will be required to prepare the final layout of the container and its equipments and have seating and living area arrangement for operating engineers and care taking staff and will get it approved from Director (TD)DG AIR. The layout & facility design should be done keeping in view broadcast and professional work flow needs for transmitter set up as per requirements as described in these specifications.
- 2.11.6 The layout should be designed to maximize the utilization of the available space without compromising' the functional and safety requirements of transmitter station.
- 2.11.7The transmitter areas should have sufficient seating for required number of operational staff alongwith furniture.
- 2.11.8 The equipments layout should be such that the container should be balanced from all sides.
- 2.11.9 The container shall have proper space for stacking of folded 60 m. unipole mast alongwith it's all accessories including ATU box & R.F.Cable etc.
- 2.11.10 The container shall have proper arrangement like cupboard etc. for storing/stacking spares.
- 2.11.11 The container shall have proper bedding arrangement in tier alongwith lockers for operating/caretaking personnel.
- 2.11.12 The offer should also include aesthetically designed, high quality Power Distribution Panel(s) with Change Over Switch with provision of operating on mains and DG, Separate Circuits & Switch Gears for equipment racks, internal lighting and air conditioning according to the cooling load requirements.
- 2.11.13 The interior of the container should be fitted with aesthetically designed &adequate quantity of compact fluorescent light (CFL) fittings to give proper illunmination needed for operation and maintenance.
- 2.11.14 The requirement of Air conditioning is estimated to be about 6 TR. However it is required to be indicated by the tenderer as per, the calculation of the heat load of the transmitter and container keeping in view the tropical climate of India for use any where and give the full design of the A/C system for the container. Multiple water cooled window type A/C units should be provided to ensure the stand by operations in case of the failure. Proper ventilation arrangement shall be provided during non operational period of AC units.
- 2.11.15 The mounting of air-conditioning equipment should be such that it should not cause any hindrance to parking of container.

**SECTION - III**  
**TECHNICAL SPECIFICATIONS OF TRANSMITTER EQUIPMENT**  
**AND ACCESSORIES**

**3.1 Ambient Conditions:**

The equipment covered by these specifications shall be required to work at various AIR sites under the Ambient Conditions as follows:

- a) Ambient Temperature : 0 to 50°C
- b) Humidity : 0 to 95% Non-condensing.
- c) Altitude : 0 to 1000 Mt.

3.1.1 20' ISO CONTAINER: : As mentioned in section II

**3.2 10 kW MW Transmitter :**

<b>S. No.</b>	<b>Parameters</b>	<b>Specifications</b>
3.2.1	Type of Emission	A3E (Double side Band, full Carrier B'casting)
3.2.2	R.F. Range	525 - 1605 kHz.
3.2.3	Carrier Frequency stability	Within $\pm 10$ Hz as per the latest ITU-R Radio Regulations in force of the time of Delivery of the Transmitter equipment, whichever is better.
3.2.3	Carrier Output Power	10 KW, The transmitter will be capable of +10% overrating with 100% modulation.
3.2.4	Reduced power operation	5 KW, with at least 3 preset power levels. <b>N.B. :</b> Typical performance figures of the transmitter shall be enclosed with the Tender.
3.2.5	Spurious and Harmonic Radiation	As per the latest Radio Regulation in force at the time of delivery of the equipment. As per ITU-R the harmonic contents should be 60 dB below the rated carrier power at fundamental frequency.
3.2.6	Carrier Level Shift	$\leq 1\%$ from 0 to 100% modulation at 1 kHz (Mains voltage variation excluded)
3.2.7	Noise Level below Carrier	$\geq -60$ dB (Un-weighted) w.r.t. full R.F. level at 100% modulation with 1 KHz tone.
3.2.8	Output R.F. Impedance	50 Ohms (Unbalanced)
3.2.9	Load mismatch / VSWR withstand Capacity	<ol style="list-style-type: none"> <li>1. Full rated R.F. output upto a VSWR of 1:1.25. (Continuously at least 12 hrs.)</li> <li>2. Reduced R.F. output (within safe limits) for VSWR from 1:1.25 to 1:1.5.</li> <li>3. At VSWR greater than 1:1.5 <ol style="list-style-type: none"> <li>i. The transmitter should make three attempts of switching ON before switching OFF permanently.</li> </ol> </li> </ol>

		ii. For switching-on the transmitter again, Manual Intervention shall be required. <b>NB</b> : R.F. output vs. VSWR relationship for equipment offered would be specified by the tenderer.
3.2.10	Type of Modulation	(a) Amplitude modulation. The modulation pattern will be seen on CRO for proof of fidelity of modulation for Triangular / Saw-tooth / Square / Rectangular wave forms. (b) Compatible for Digital Modulation as per DRM standard
3.2.11	Modulation capability	Continuous 70% Sine Wave Tone modulation 30 Hz to 10kHz.
3.2.12	Peak Modulation capability	Up to 110% positive peak programme modulation at nominal carrier power for 1 minute.
3.2.13	Modulation Linearity	Within + 0.5 dB w.r.t 70% modulation at 1 kHz
3.2.14	Audio input level	0 dBu ( Nominal for 100% modulation, adjustable from -10 to +10 dBu in steps of 1 dB.
3.2.15	Audio Input Overload Protection	The Audio Input level will be protected upto 10dB higher level over the nominal audio level required for 100% modulation without tripping transmitter.
3.2.16	Audio input impedance	600 Ohms (balanced)/110 ohms for AES
3.2.17	Audio Frequency Response	$\pm 1.0$ dB from 30 Hz to 10 kHz w.r.t 70% modulation at 1kHz.
3.2.18	Total Audio Harmonic Distortion	$\leq 1.0\%$ from 30 to 95% modulation between 30 Hz to 10 kHz
3.2.19	Inter Modulation Distortion	$\leq 1.0\%$ at 60/7000 Hz. 4:1 at 95% modulation as per SMPTE standards.
3.2.20	Square Wave Overshoot without filter	$\leq 1\%$ at 400 Hz 80% modulation
3.2.21	Square Wave Tilt	$\leq 2\%$ at 40 Hz 80% modulation.
3.2.22	A.C. Mains input	1. 400 V $\pm 10\%$ , 3 phase, 50 Hz $\pm 2$ Hz, for the Transmitter(without AVR). 2. An AVR of rating specified under para - 3.3 of this section will be included to meet the A.C. mains input voltage variations at site conditions. 3. The various loads within the transmitter shall be evenly distributed on the three phases of AC mains. The load unbalance between the three phases at the Mains Input of the transmitter shall not exceed $\pm 5\%$ .
3.2.23	Power Factor	$\geq 0.95$ excluding the AVR.
3.2.24	Overall Efficiency	$\geq 80\%$ (including AVR and all the ancillary equipment of the transmitter) from 0 to 100% modulation. <b>NB</b> : Calculation to be enclosed
3.2.25	Acoustic Noise due to rotating machinery	$\leq 65$ dB A at 1.5 meters from the Transmitter panel.
3.2.26	Transmitter protection	MOVs or any other fast acting device will be provided on AC input line to prevent damage to any component of the transmitter and AVR against voltage transients of at least up to 1000 volts on AC Mains Input.

### 3.3 AUTOMATIC VOLTAGE REGULATOR (AVR) :

S. No.	Parameters	Specifications
3.3.1	Capacity	50 kVA
3.3.2	Input voltage	320 V A C to 480 V , 3 phase, 50 Hz +2 Hz
3.3.3	Output voltage	400 V A C + 1% 3 phase 50 Hz + 2 Hz

#### 3.4 DUMMY LOAD:

S. No.	Parameters	Specifications
3.4.1	Capacity	20 KW r.m.s.
3.4.2	Input Impedance	50 Ohms + 2%
3.4.3	Frequency Range	525 – 1605 kHz
3.4.4	Mains Input supply for system	400 V A C +10% 3 phase/230V, 1 $\phi$ , 50 Hz + 2 Hz

#### 3.5 RF/ ANTENNA CHANGE OVER SWITCH:

S. No.	Parameters	Specifications
3.5.1	R.F. Power Handling Capacity	20 kW r.m.s.
3.5.2	Switch Impedance	50 Ohm + 2%
3.5.3	Mismatch/VSWR due to switch	< 1.05
3.5.4	Frequency range	525 – 1605 kHz
3.5.5	Mains Input for motor and Status/Indications etc.	230 VAC + 10%, 1 Phase/ 400 V, 3phase, 50 Hz + 2 Hz
3.5.6	R.F. Isolation between ports	More than 40 dB

#### 3.6 ANTENNA TUNNING UNIT (ATU), MAST & RF FEEDER:

S. No.	Parameters	Specifications
3.6.1	Power Handling Capacity	20 kW carrier + 150% Modulation
3.6.2	Frequency range	525 – 1605 kHz
3.6.3	Input impedance	50 Ohms unbalanced
3.6.4	Output Impedance	To be designed to match folded unipole Antenna Impedance in the entire MF band .
3.6.5	RF Cable (Actual length will be mentioned in the purchase order.)	1-5/8" Foam dielectric, RF cable along with accessories to handle RF power(20 kW+150% modulation) having connection of suitable type and size on both ends. Loss $\leq$ .09dB/100mtr.
3.6.6	self radiating antenna	shunt fed self radiating 60 mtr. high folded unipole grounded mobile mast 20 KW carrier power +150% modulation rating alongwith portable ground screen

#### 3.7 PROGRAMME INPUT EQUIPMENT RACK:

S. No.	Parameters	Specifications
3.7.1	Wired Rack	
	Normal input level	-20dBu to +5dBu across 600 ohms ( Selectable)
	Normal output level	+10 dBm across 600 ohms through an attenuator for wiring ( < $\pm$ 1.0 dB with chain including Repeat Coil )
	Frequency Response	+0.5 dB ( 20 Hz. to 20 kHz.)
	Inter-channel cross-talk	Better than 60 dB
3.7.2	Programme/ VU Meter	

	a) Measurement Range	-40dB to -10dB in 3dB steps -10dB to +20dB in 1dB steps
	b) No. of Display LEDs	40 in 3 colors per channel
	Input Impedance	>10k ohms
	c) Tolerance	+ 1LED(0.5dB)
	d) Power Supply:	230V + 10%, 50Hz + 2Hz
3.7.3	<b><u>Audio Patch Panel/ JACK FIELD</u></b>	
	a) No. of Jacks	48 in two rows (24 in one row)
	b) Contact Resistance	<0.015ohm
	c) Insulation resistance	> 100 M Ohms between GND & contact
	d) Working Voltage	100V DC
	e) Dimensions	3U (Height), 19"
3.7.4	<b>Repeat Coil</b>	
	a) Frequency Response	+ 0.5dB ( 30 to 15000Hz)
	b) Maximum Level	27dBm for negligible wave form distortion over the entire frequency range.
	c) Unbalanced D.C.	Nil in primary or secondary
	d) Insertion Loss	Less than 1dB over the stipulated frequency range.
3.7.5	<b>MONITORING AMPLIFIER</b>	
	<b>a) INPUT</b>	
	(i) No. of Inputs	One stereo on X.L.R.
	(ii) Input level	-10dbu to + 10dbu. Nom. 0 dBu
	(iii) Input impedance	>10K Ohms (Balanced).
	<b>b) OUTPUT</b>	
	(i) Power Output	20W per channel in 8 Ohm 30W per channel in 4 Ohm
	(ii) Frequency Response	+ 0.5db 20 Hz to 20 kHz (Filters by Pass)
	(iii) Total Harmonic Distortion at 1 kHz	≤ 0.2% at rated outputs.
	(iv) Signal to noise ratio	≥ 100 dB
	at rated output (unweighted rms.)	
	(v) Power Supply	230V AC + 10% 50 Hz+ 2Hz
	(vi) Level difference between the channels.	< 0.5 db.
	( vii) Inter-channel X- talk	≥ 50db.
3.7.6	<b>AUDIO DISTRIBUTION AMPLIFIER</b>	
	<b>a) INPUT</b>	
	i) Input level	0 dbu nominal + 20 dbu Maximum
	ii) Input impedance	≥5 K Ohms (Balanced)
	<b>b) OUTPUT</b>	Six Mono/three stereo
	i) Output level	0dbu to + 20 dbu maximum into 600 Ohms
	ii) Output impedance	< 50 Ohms (Balanced)
	iii) Gain control	+ 6 db (Min.)
	iv) Frequency response	+ 0.5 db 20 Hz to 15 KHz
	v) Signal to Noise ratio	> 75 dB w.r.t. to nominal output
	vi) Inter channel level difference	≤ 0.5 db 20 Hz to 20 KHz
	b) T.H.D	< 0.3% max. 30 Hz to 20 KHz
	c) IMD	< 0.1%
	d) Inter channel cross talk	> 65 db 20 Hz to 20 KHz
	e) Operating Voltage	230 V + 10% , 50 Hz+2Hz
3.7.7	<b>AUDIO PROCESSOR</b>	

(a)	Frequency response	< + 0.5 dB
(b)	Signal to Noise Ratio	>75 dB reference to 100% modulation 50 Hz to 15 kHz
(c)	Total Harmonic Distortion	< 0.25% at 100% modulation 50 Hz to 10 KHz
(d)	Gain	- 15 dB to + 15 dB (Test Mode )
(e)	Sine wave Tone	Programmable 30 Hz to 10 kHz 0 – 95% Modulation ( Test mode)
(f)	Square wave Tone	Programme link 63 Hz to 1 kHz 0 – 50% Modulation (Test mode)
	<b>Audio Input/ Output (Analog )</b>	
(g)	No. of input channels	One Monoaural
(h)	Low pass filter	4.5 KHz. & 9.0 KHz.
(i)	High pass filter	50 Hz to 100 Hz in suitable steps.
(j)	Audio Input Level	-20dBu to + 20 dBu
(k)	Audio Input Impedance	600Ω balanced or bridging, jumper selectable
(l)	Sensitivity	-20dBu to +20dBu selectable with adjustable control on front panel software
(m)	Maximum input level	20dBu
(n)	No. of outputs	2 Monoaural/ (independently variable)
(o)	Audio Output Level	0 to +20 dBu into load impedance of 600 ohms balanced
(p)	Maximum out put level .	+20 dBu
(q)	Operating voltage	230 V $\pm$ 10%, 50 Hz $\pm$ 2Hz,
3.7.8	<b>Modulation Monitor</b>	
a	R.F. Frequency Range	500 KHz to 40 MHz in 1 kHz. Increments.
b	R.F. Input	5 Vrms
c	R.F. Input Impedance.	50/75 ohms
d.	Modulation Meter Range	0 to 130% with dB scale
e.	Modulation Accuracy	+ 2% at 100% modulation with Sinusoidal signal.
f.	Carrier Level Deviation Meter Range	$\pm$ 30%
g.	Carrier Level (Loss) Alarm	Alarm with a 30% drop from nominal carrier level
h.	Peak flasher Indicator levels	Adjustable upto to 130% for +ve peak.
i.	Peak Modulation Accuracy	+ 2% at 98% modulation
j.	Audio Test Output (i) (ii)	5 Vrms, rear panel BNC connector (Unbal.) 0 dBm (0.775 Vrms), 600 Ω (balanced)
k.	Audio Frequency Response	+ 0.5 dB, 20 Hz to 15 kHz.;
l	Total Harmonic Distortion(AF)	< 0.25% Max. at 99% modulation.
m	Signal to Noise Ratio	Better than 75 dB
n	Protection against RF Interference	The equipment shall be provided with adequate shielding against RF/ EMI interference
o	Power Requirements	230V $\pm$ 10%, 50 Hz $\pm$ 4%
3.7.9	<b>Cathode Ray Oscilloscope</b>	As per Tektronix model DPO-4032
3.7.10	<b>Synthesized Receiver</b>	All Wave world receiver for re-broadcast/ monitoring purpose installed & wired in PIR
3.8	Emergency play back arrangement consisting of following (a)4 channel audio Mixer (b)DVD Player (c)Mike with stand (d) Fixture for above	OB type To play DVD, CD etc. Cardiod type Suitable for mobile set up
3.9	<b>DTH Set</b>	For Receiving KU band DD/AIR channels.

### 3.10 SPLIT TYPE AC UNITS/VENTILATION OF CONTAINER:

3 nos. of 2 TR Air cooled split type A/C unit shall be provided for cooling transmitter and other area of entire container. This however, is subject to the cooling decided/calculated by the tenderer as per cooling requirements of transmitter, it's accessories & container.

Adequate numbers of suitable size exhaust fans to take care of the heat load of the transmitter & equipments, floor standing fan to take care of ventilation of the container when the A/C Units are not working, shall also be provided. In addition pedestal fan shall also be provided for localized ventilation near operational area or in rest area portion of container when A/C units are not working.

### 3.11 62.5 KVA D/G SET WITH AMF PANEL:

62.5 KVA (N.T.P.) silent type stand alone mounted in acoustically treated canopy with required ventilation arrangements D/G set shall be provided for working anywhere in India under all environmental conditions. The diesel storage shall be part of canopy. As this D/G set is for use anywhere in India, proper arrangement for ventilation of D/G set & cooling of engine under all environmental conditions shall be provided.

#### SECTION - IV (SCHEDULE OF REQUIREMENTS)

AIR requires the following equipment / services as per technical specifications detailed under Sections

I, II & III. The tenderer shall quote price of each item separately with necessary break-up details keeping in view the following:

i) Make & Model of each item, to be indicated.

ii) Indenter reserves the right to choose & decide the quantity of Equipments at the time of finalization of Tender.iii) All items mentioned except optional will be taken in to consideration for ranking purpose

S. No.	Equipment	Quantity
4.0	10 KW MW Transmitter Set up Mobile Each set up comprising of the following :	6 sets
4.1	10 KW MW DRM compatible AM Solid state Transmitter and all accessories integrated/installed in 20' ISO container including earth electrode kits.	1 No./set
4.2	20' ISO container with required ventilation (AC& Fan) system having all the facilities and fully furnished as defined in section-III for working as a mobile broadcasting set up which can be transported in a trailer truck any where in India as per requirement of AIR.	1 No/Set
4.3	50 KVA Automatic voltage regulator (AVR) as per specification Section-III para-3.3	1 No/set.
4.4	20 KW Dummy Load as per specification Section-III para—3.4	1 No./set.
4.5	20 KW 4 port RF changeover switch ( Antenna/Dummy load)/ Standby Tr. as per specification Section-III para—3.5	1 No./set
4.6	1-5/8" Foam dielectric, 50 ohm R.F. coaxial cable complete with RF Connectors at both ends and other cable accessories, wound on a drum & housed/racked at a suitable location in container as per Para 3.6.5.	2 lengths 100 mtr each/set
4.7	20 KW carrier power +150% modulation capacity ATU housed in a weather proof Aluminium box with pedestal as per specification section III, Para 3.6.	1 no/set
4.8	60 mtr. grounded vertical folded unipole omnidirectional mast with erection kit and associated material, ground screen & earthing kit etc.as per Para 3.6.6	1 no/set
4.9	Wired-up stereo Programme Input Rack comprising of followings:	1 no./set
	Wired-up Rack with Programme Meter (PPM/VU) as well as selector switch, Audio Patch Panel, R.F. Patch Panel, Monitoring Loudspeaker, Prog. Selector Switch, Selector Switch for Monitoring, Cooling fan, Repeat Coils, High Impedance Headphone & Power Supply panel with mains switch, mains filter, MCBs for distribution Along with the following Equipments:	1 No./set
4.9.1	Distribution Amplifier	1 No./set
4.9.2	Monitoring Amplifier (20W)	1 No. /set
4.9.3	Audio Processor	1 No./set
4.9.4	Modulation Monitor	1 No. /set
4.9.5	Cathode Ray Oscilloscope	1 No. /set
4.9.6	All wave synthesized world receivers	1 No/ set
4.10	Emergency play back arrangement consisting of following: a)4 channel audio Mixer b)DVD player c)Mike with stand d)Fixture for above	
4.11	DTH Set for Receiving KU band DD/AIR Channel	1 No./set

4.12	Charges for complete integration/installation material for all the above items (sl. No. 4.1 to 4.11)	1 lot/set
4.13	Charges for factory inspection/Acceptance tests by AIR engineers including charges , if any, for arranging the power supply at 50 Hz for testing the equipment. (Please refer para 1.11 of Section-I)	1 lot
4.14	Delivery of the entire equipment at the respective AIR site including custom clearance and Insurance etc.	1 lot/set
4.15	Installation Testing and commissioning manuals for the Transmitter and all associated Equipment . (Please refer para 1.4 of Section - I).	3 Nos./set
4.16	Operation, maintenance manuals and trouble shooting for Transmitter and all associated Equipment (Please refer para 1.6 of Section - I)	7 nos./set
4.17.	Essential working of spares for the transmitter & accessories. Each set comprising of following:	1 lot/set
4.17.1	PA Modules	2 Nos./set
4.17.2	PCBs for all the pre P.A. R.F. stages( <u>List to be given</u> )	Nos./set
4.17.3	PCBs for the Audio processing and modulation encoding stages	Nos./set
4.17.4	All type Control Circuit PCBs ( <u>List to be given</u> )	nos./set
4.17.5	Discrete components like power transistors (MOSFETs), main I.C 's , Semi conductors & other special components(List to be given)	1 lot/set
4.17.6	Spares for the AVR.	1 lot/set.
4.17.7	Spares for the dummy load	1 lot/set.
4.17.8	Other items of spares recommended by the tenderer <i>for maintenance of the equipment for 2 years</i>	1 set/set
4.18	62.5 KVA(NTP) standalone silent type of D/G set as per specs.	1set/set
4.19	<b>OPTIONAL SPARES /ITEMS</b>	
4.19.1	Extended/Remote control & monitoring facilities as per Para 2.1.8 of II.	1 No./set
4.19.2	Charges (with break-up details of items) for making Tx DRM Compatible in DRM simulcast mode alongwith DRM eqpts.	1 lot/set

## ANNEXURE - I

### **Guidelines for ATP of the Transmitter Accessories:**

(ACCEPTANCE TEST PROCEDURE FOR THE TRANSMITTER AND ACCESSORIES)

#### **1. General :-**

1.1 The Transmitter Equipment and the various accessories ordered shall be accepted only after inspection and testing by All India Radio as per the "Acceptance Test Procedure" detailed in this Annexure.

1.2 The manufacturer/contractor shall put up the equipment for Inspection / Testing and Acceptance of the Inspectors deputed by All India Radio, only after being satisfied themselves first that the equipment offered meets the stipulated standards and specifications.

1.3 The contractor shall dispatch the equipment to AIR only after it has passed the various tests as per this ATP and certified to be acceptable (vide para-4 below) by the Inspectors of AIR.

#### **2. Inspection/Testing of Equipment at Manufacturer's Works:**

AIR's inspectors shall carry out the following tests at the manufacturer's works:-

##### **2.1 Physical/Visual Inspection:**

A physical/visual inspection of the equipment offered shall be carried-out to ascertain the following:

a) **Quality of Material:** The material used in the manufacture of the equipment and its workmanship is of high quality.

b) **Standard Manufacturing Practice:** The various standard practices used for manufacture of high quality broadcast equipment have been adopted in manufacture of the equipment.

c) **Quality checks during manufacture:** The certificates issued by the manufacturers of the various items/sub assemblies on the quality checks done during manufacture will be put up by the contractor for perusal/scrutiny of the AIR inspectors.

d) **Identification / Labeling of Sub-Assemblies:** All the sub-assemblies have been identified and all the wiring have been labeled with corresponding numbers / references in the Erection / Technical Manuals.

e) **Conformation to AIR Specifications:** The various provisions in the equipment offered conform to Sections - I, II & III of AIR specifications.

##### **2.2 Control-circuit protection and interlocking:**

a) **Control circuit:** The control circuits of the transmitter will be tested for proper switching-on and switching-off sequences. The various indications during the switching-on and switching-off process shall be checked against those specified in the Technical/Operation Manual.

b) **Protection and Overloads:** The settings of the various protective and over load circuits/devices will be checked against those specified in the technical manual and their operation will be checked by suitable simulations.

c) **Interlocking:** The various interlockings for the safe and sequential operation of the transmitter will be checked as specified in the Technical Manual. The interlocking of the transmitter with the antenna changeover switch, dummy load and ATU / Antenna will also be checked for proper operation.

##### **d) Protective / Control Circuits of the Auxiliary Equipment:**

The protective, over load and interlocking circuits of the various auxiliary equipments like AVR, Dummy Load and Antenna Change over switch and ATU etc. will be checked for proper operation.

##### **2.3 Performance tests on the equipment:**

All the equipment ordered shall be tested against the technical specifications stipulated under Section-III of these specifications or the technical parameters of the equipment claimed by the contractor whichever are better.

The equipment shall be tested at the Mains Input specified for the various equipment under Section - III i.e. 400 V AC  $\pm$  20% (with AVR), 3 phase / 230 V AC (Nominal)  $\pm$ 10%, 1 phase; 50 Hz  $\pm$ 2Hz.

The methodology adopted for testing the equipment shall be as follows:-

a) Out of the equipment offered for inspection / testing by AIR inspectors at the manufacturer's works, one of the transmitters (selected at random) along with the complete set of its auxiliary equipment like Dummy Load etc. shall be tested as per ATP.

- b) After successful testing of the technical performance of the transmitter as specified under para 2.3 (a) above, Heat run test for 24 hours shall be conducted on the transmitter as per para 1.11.2.3 (e) of Section-I of these specifications.
- c) Any other tests which may be found necessary to prove the performance of the equipment as a result of the preceding tests or as a result of the inspection by the inspecting authority as per para 7.2(f) of Section - I of these specifications.
- d) Remaining sets of Transmitters and their accessories, shall be tested only at station frequency , for the various technical parameters (including DCC ) specified under Section-III of these specifications.
- e) The remaining equipment (not covered under para 2.3 (a) to 2.3 (c) ) like ATU etc. shall be tested to check their performance as per the technical parameters specified under Section - III of these specifications or the technical parameters claimed by the contractor whichever are better.

**f) Testing of Spares:**

All the Sub assemblies / amplifiers / oscillators and PCBs etc, ordered as spares shall be tested in circuit and performance of the equipment shall be checked against the specifications. The various discrete components, ordered as spares, shall be checked physically / visually.

**3. Testing of equipment at AIR site:**

After installation of the various equipment at the respective AIR sites, tests shall be carried out as per paras 2.3 to 2.3(e) above except that these equipment shall be tested only at the assigned station frequency at the particular AIR site.

**4. Documentation of Inspection / Tests Results at manufacturers works:**

The results of the various tests conducted at the manufacturer's works as per para 2 above shall be documented neatly and signed by the AIR's inspectors and contractor's authorized representatives. Three sets of these signed documents shall be handed over by the contractor to the AIR's inspector. The certificates mentioned under para 2.1 (c) above shall be attached along with the results of the Inspection / Tests Report.

**5. Seal of inspection:**

AIR's inspector will affix a seal of inspection on each equipment which has passed the Acceptance Tests at the manufacturer's works. The equipment shall be shipped only after the inspection and acceptance of the same by the AIR's inspector.

**6. Documentation of Inspection/Test Results at AIR site:**

The results of the various tests conducted at AIR site, as per para 3 above shall also be documented neatly and signed by AIR's representatives and the contractors representative (incase the testing and commissioning of the equipment is ordered by AIR on the contractor).