

P R A S A R B H A R A T I
DIRECTORATE GENERAL : ALL INDIA RADIO
PLANNING AND DEVELOPMENT UNIT
NEW DELHI – 110 001.

**SPECIFICATION FOR SUPPLY OF 100 WATT SOLID STATE
FM BROADCAST TRANSMITTER**

SPECIFICATION NO. : 100 Watts VHF Tx. / 2006

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INTRODUCTION

This Specification is for supply of 100 Watts VHF, Solid State Broadcast Transmitter in (1+1) configuration with Auxiliary Equipment and VHF Antenna to be installed at various sites in India.

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N. B. : Each statement of this specification has to be complied with and supported by printed matter from the manufacturer of the equipment by the Tenderer, without which tender will be considered incomplete and liable to be rejected. The Tenderer should make a detailed offer while quoting for the main Transmitter including all ancillary Equipment etc.

SECTION-I

SCHEDULE OF REQUIREMENTS/MATERIALS

- 1.1 AIR is interested to procure 100 Watts, solid state FM Transmitter in (1+1) configuration. These 100 Watt transmitters Units will be as per the specifications of AIR given on the following pages. The transmitters should be rugged, reliable and stable in operation under Indian tropical condition.
- 1.2 The FM Transmitter Units are to be supplied as “complete system” including , cooling system (air cooled with built-in fan unit), ACU, UPS, PDP (Power Distribution Panel) interconnecting cables, installation materials etc. as per the Bill of Material in Para 1.6, below. For commercial / technical evaluation purposes complete group of items will be evaluated as a group and part supply shall not be acceptable. Optional items are also to be quoted and these will be commercially evaluated separately.
- 1.3 The system should be quoted with each product's detailed specifications, data sheets and pamphlets. Any other item / equipment, which is essential for the completeness of the system, should also be included in the offer. It will be the responsibility of the tenderer to ensure that the system is complete in all respects.
- 1.4 A detailed block schematic diagram for the entire FM Transmitter system with all its constituent items should be provided with the offer. The equipment layout with dimensions of all equipment in the rack shall also be attached.
- 1.5 A suggestive block diagram of transmitter in 1+1 configuration is enclosed for the information of the supplier at Annexure-III. (Diagram 1). The suggestive layout of the various equipment in the Equipment rack is also enclosed at Annexure-IV. (Diagram 2). The Tenderer can improve over these for their detailed proposal.
- 1.6 The broad scope of the supply is as follows:
(Price for each item is to be quoted separately)

<u>S.NO.</u>	<u>EQUIPMENT</u>	<u>QUANTITY</u>
1.0	Transmitter	
1.1	Supply of 100 watt VHF FM Transmitter (including in-built Exciter, Stereo Generator & Encoder Card) with Automatic changeover Unit (ACU) for operating in (1+1) automatic mode with manual over-ride. (Each set shall comprise of 2 nos. of 100 Watts transmitter Unit)	N sets
1.2	Supply of 250 watts Dummy Load with suitable line section and mounted in equipment rack with suitable RF feeder Cable. (1 no. with each set)	N nos.
1.3	Manuals on Theory, Operation, Installation, Testing, Commissioning and Maintenance.	N + 14 .
2.	Supply of Equipment Rack for mounting of Transmitter, ACU, UPS and Dummy load.(1 no. with each set)	N nos.

3.	Supply of VHF Antenna (500 watts) with complete installation material and mounting fixtures. (1 no. with each set)	N nos.
4.	Supply of 7/8" Foam Dielectric RF Cable (60 mtr* length) for feeding to Antenna with suitable connectors. (The cable shall be complete with end connectors, hoisting grips and cable clamps and complete in all respect for its hoisting.) (Rate per Unit length to be quoted and Exact length will be intimated at the time of placement of order) *(For ranking purpose)	N nos.
5.	Supply of 1 KVA Online Uninterrupted Power Supply System {UPS} alongwith Maintenance free Batteries for 30 Min. Backup (at full load of 1 KVA), necessary power cables and mounted in Equipment rack. (2 nos. of 1 KVA UPS in hot standby mode with each set)	N sets
6	Factory Test and Inspection at Manufacturer's/ System Integrator's Works as per Annexure II.	1 lot
7	A set of recommended spares for Transmitter units, Antenna, ACU, UPS and RF Cable (OPTIONAL) .	N sets

1.7 SAMPLE TESTING :

- a) *Initially one set of 100 Watts FM Transmitter System shall be supplied for sample testing and actual field trial operation by AIR as per details provided in Annexure-I. Balance quantity of FM Transmitter system shall be supplied only after successful trial and acceptance by AIR (Design Section) and after issuance of test acceptance certificate by Purchase Section of this Directorate. In case some minor modifications / rectifications are found necessary as a consequence of the field trial test the same shall be incorporated and carried in all sets of FM Transmitter system without any extra cost.*
- b) *The sample shall be supplied by the contractor free of cost. Any expenses incurred by the contractor on or in connection with the production of stores in bulk, before sample has been approved, unconditionally, shall be borne by the contractor and he shall not claim any compensation in the event of such sample being found unacceptable after testing.*
- c) *The rejection of the sample by the Inspecting Officer or Inspector shall be final and binding on the Contractor.*

1.8 The following are excluded from the scope and will be provided by AIR:

- a) Construction of necessary buildings, all masonry works and materials connected therewith, masonry Foundations, Cable Trenches and under floor ducts (Dimensions for which are to be furnished by the Transmitter supplier) if any.
- b) Electric supply connection for the transmitting equipment, at a single point.
- c) Tower for mounting Antennae, Cable tray for mounting RF Cable.
- d) Furniture and fittings not forming a part of the transmitter equipment.
- e) Installation of equipment at various sites.
- f) Commissioning of Transmitters at sites.

SECTION-II

GENERAL TERMS AND CONDITIONS

2.1 INFORMATION TO BE SUPPLIED:

2.1.1 LANGUAGE/ UNITS:

All information supplied by the tenderer and all markings, notes, designation on the drawings and associated write-ups including Instruction Manuals shall be in "English language" only. All dimensions and units on drawings and all references to weights and measures and quantities shall be in metric units.

2.1.2 INFORMATION TO BE SUPPLIED WITH THE TENDER :

(The tender and the associated information should be submitted in triplicate.)

- a) A Compliance Statement to the complete specifications.
- b) Complete printed information in support of compliance statement should be furnished with the tender to assess the full merit of the offer. Similar information should be furnished in respect of auxiliary items, Accessories and Spares.
- c) Descriptive information giving complete details of Equipment offered.
- d) Detailed bill of materials offered. This list should be in the same format as in the price bid without indicating the prices.
- e) Make and type number of individual units alongwith details.
- f) Layout and construction details of Transmitter and external units including dimensions, weights, overall sizes and photographs of the interior of the Transmitter. (This should include characteristics affecting the environment, for example; heat dissipation and acoustic noise, tentative accommodation plan with elevations for Transmitter and accessories.).
- g) Details and extent of ventilation and air- conditioning requirements, if any, for main Transmitter and its accessories.
- g) Information and characteristics of all high power semiconductor devices used in the Equipment.
- h) Details of MTBF (Mean Time Between Failure) alongwith the basis of calculation.
- i) Details of failure of individual devices, components based upon field feedback reports.
- j) An up to date list of the customers along with complete set of actual performance figures taken on the Transmitter in support of tenderer's claim.
- k) A supply record of similar Transmitters year wise alongwith the Names, Addresses, e-mail and fax numbers of customers.
- l) A general undertaking to accept the guarantee by the tenderer as mentioned in 2.5.

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

Four sets of Installation, Commissioning, Operation and Maintenance manuals for main Transmitter and all auxiliary equipment each shall be supplied to "The Director

Engg. (Projects), P & D UNIT , DG:AIR, New Delhi-1”, and two each to four Zonal Offices , and to “The Chief Engineer, Staff Training Institute (Technical), AIR & TV, Kingsway, Radio Colony, Delhi”.

within one month of Acceptance of Tender. All the details should be complete and exhaustive.

2.1.4 INFORMATION TO PRECEDE DESPATCH OF EQUIPMENT:

Following information should be supplied to the Director Engg. (Projects), P & D UNIT, AIR and each of the consignee, two months prior to despatch of Equipment :

- a) Detailed list of equipment under despatch.
- b) Photograph showing location of components in the various units and sub units with item numbers marked thereon.

2.1.5 INFORMATION TO BE SUPPLIED ALONGWITH EQUIPMENT:

For each Transmitter one copy of printed and duly bound manuals and books for Installation, Testing, Commissioning, Operation, Maintenance is to be supplied to each consignee alongwith the transmitter.

One copy of the Inspection Report of the inspection carried out at factory should also be enclosed with the copy of consignee.

2.2 DELIVERY OF EQUIPMENT

Three months from the receipt of purchase order.

2.3 PACKING AND PACKING LISTS

All the equipment should be securely and properly packed to withstand transit hazards. Equipment packing shall be fit for sea freight and incorporate adequate protection against ingress of moisture. Packing slips giving details of the items contained in each package shall be placed inside the package in a water proof envelop to enable easy identification and should contain cross references to item/part numbers of installation drawings/components lists. Copies of packing slips and other details should be sent separately to respective consignee and also to The Director Engg. (Projects), P & D UNIT , AIR, New Delhi.

2.4 INSURANCE AND MARINE RISKS ETC.

Please refer to commercial terms.

2.5 GUARANTEE:

Tenderer shall submit with his tender an undertaking to accept the following guarantees:

2.5.1 A guarantee that the equipment supplied will be in accordance with these specifications, varied only to the extent stated in his tender and agreed to in the contract.

2.5.2 A guarantee to make good within **30 days** at his own expense any component which becomes defective under normal operating conditions **within 18 months** from the date of acceptance of Equipment at respective site.

2.5.3 A guarantee to supply all components for a period of ten years from the date of acceptance of Transmitter at site, at rates at which these are being supplied by him to other customers and also should match prices of original manufactures of these components prevailing at that time.

2.5.4 If at any stage during next 10 years, the manufacturer stops production of this model of transmitter, he shall intimate All India Radio in advance to enable the latter to stock the critical items.

2.6 INSPECTION

Inspection/Field trial/ testing of one Sample unit shall be carried out at AIR site by representative of DG:AIR as per details in Annexure-I . Detailed inspection of the balance quantity will be carried out at Manufacturer's System Integrator's works by representative of DG:AIR as per detail given in **Annexure II**. The Manufacturer / Supplier shall put up all the Transmitter units to be supplied for Inspection , out of which 10 % transmitters Unit selected randomly shall be put for test on the test bench , at his premises before the representative. The supplier shall provide without any extra charges electric energy, consumable materials, tools, testing instruments, labour and assistance of every kind for carrying out acceptance tests.

Complete specifications and details will be checked and value of all parameter values will be measured. The acceptance to this clause has to be clearly stated by the Tenderer.

Prior intimation for carrying out Inspection at works is to be given by the supplier to the indenter at least 2 weeks in advance. Inspection period will be 5 working days. Expenses for inspection charges on account of providing of infrastructure only are to be quoted. The expenditure towards To and Fro Air journey, lodging, boarding & DA in respect of Inspector will be born by AIR.

2.7 INSTALLATION AND COMMISSIONING

The Transmitter will be installed and commissioned by AIR in accordance with the instructions and drawings of manufacturer.

2.8 AFTER SALES SERVICE

The supply of transmitter may require after sales services. Therefore full details of facilities for carrying out after sale service may be given.

SECTION III

DETAILED TECHNICAL SPECIFICATIONS FOR 100 WATTS TRANSMITTER UNIT

3.0 Brief Description:

Two nos. of 100 watts FM transmitter units shall be supplied with each set of Transmitter. Both the 100 watts FM transmitter unit shall be configured to operate in (1+1) mode i.e. one no. of 100 Watts Tx. unit will operate in active mode and other 100 watts unit will remain as passive standby mode. The operation in (1+1) mode is done by an Automatic changeover Unit (ACU), the detailed specifications for which are given in Section-V.

3.1 100 watts Transmitter Unit:

- 3.1.1 The FM Transmitter unit shall be consistent with the latest state-of-the-art technology using most rugged reliable components, circuit design and shall be suitable for unattended operation. It should be user friendly and simple to operate.
- 3.1.2 All equipment assemblies, sub assemblies, PCB's, devices and components should be of latest field proven design. All materials used in the FM Transmitter System should be of Professional Broadcast Quality.
- 3.1.3 The Transmitter system quoted must conform to the latest international standards of safety and EMC. The conformance to such standards (indicating Standard's Name and Number) must be stated in compliance statement. The transmitter Unit should be ISO 9001 certified.
- 3.1.4 The Transmitter unit shall be suitable for FM monophonic and stereophonic/multiplex transmission in the frequency range of 87.5 to 108 MHz.
- 3.1.5 The manufacturer of the Transmitter and its ancillary Units should have at least 2 years experience in the field. The Transmitter and other ancillary units shall be characterized by high reliability, high MTBF. It should be field proven.
- 3.1.6 The Transmitter shall satisfy the requirement of ITU Radio Regulations. It should comply with IEC 215 Safety Standards so as to eliminate electrical hazards to the personnel.
- 3.1.7 Transmitter equipment shall have compact design. All metal works shall be adequately protected against rust and corrosion and shall be non-inflammable and fire retardant.

3.2 Facilities:

- 3.2.1 Transmitter shall have in-built Limiter and low pass filter (30 Hz to 15 kHz) at audio input to ensure distortion free transmission irrespective of source level.

The transmitter shall have in-built Stereo Encoder card.

- 3.2.2 It shall be possible to vary the Transmitter power and operate it from a low value to full value from front panel control on controller.

3.3 Circuit Design :

- 3.3.1 The Transmitter will consist of solid state devices. All stages i.e. Exciter, Amplifier, harmonic filters, etc. should be of Broad Band design for operating in the entire VHF frequency band of 87.5 to 108 MHz without need of any tuning.

3.4 Exciter :

- 3.4.1 Exciter should be compatible for mono and Stereo Broadcasting using pilot tone system conforming to ITU Recommendations 450 –1, Section 2.2.
- 3.4.2 It shall have provision for taking analog mono signal, analog stereo L and R signals, analog stereo encoded and composite signals. It shall have provision for taking digital AES/ EBU signals as well.

3.5 Power Amplifier (PA) :

- 3.5.1 The Power Amplifier (PA) shall be of wide band design for operation in the entire VHF frequency band of 87.5 to 108 MHz without tuning of components. The PA shall be rugged in design and will consist of MOSFET device incorporated in a separate amplifier board. The PA shall be provided with RF monitor located on Front Panel to monitor output RF Power.
- 3.5.2 The PA shall have built in protection against high Forward and Reflected Power (Short and Open loads). PA shall also be protected against, over current, over temperature, overdrive and airflow failure.

3.6 Power Supply:

- 3.6.1 The Transmitter shall be complete in all respects. AIR shall provide single phase, 230 Volt \pm 10%, 50 Hz \pm 4 %, power supply system at a single point. All the power supply required for the Transmitter and its auxiliary equipment should be derived from the same point.
- 3.6.2 The Transmitter shall have in built voltage stabilizer for taking care of specified variations in the main supply. The rectifier and filter circuits should be able to take care of voltage surges on power lines. Power supply unit shall be protected against over temperature, over current and over voltage etc.

3.7 Protection System :

- 3.7.1 Adequate protection system shall be provided to safe guard the transmitter from damage under fault conditions. The protection system should be fast acting to safe guard the components.

3.7.2 The transmitter should be able to protect itself if the antenna cable is cut / removed. When connection is re-made, the transmitter should work under the same parameters (frequency, power...) automatically.

3.7.3 Following are the typical requirements in this regard:

- a) Over- load protection for Transmitter as well as PA.
- b) Protection against over temperature on heat sinks.
- c) Protection against high VSWR including open and short conditions at output.
- d) Immediate power fold-back under severe/damaging fault conditions. Details of fold- back to be provided.
- e) Transmitter should be protected against lightning by providing Static discharge path and details to be given in the tender.

3.8 **Control and Interlocking:**

3.8.1 The control and interlock circuits shall ensure protection and operational safety of the equipment and personnel. They shall allow the Transmitter to be switched in or out of service in a proper sequence only by operation of switch buttons. Switching in of the auxiliary units such as Dummy Load, reject loads, Blower/ fan etc. shall be suitably interlocked.

3.8.2 Details of control/monitoring/protection unit should be given. Stages of sequential operations of switching 'ON' and 'OFF' of the Transmitter shall be indicated. In addition, tripping and power fold back shall remain indicated until reset.

3.8.3 It shall be possible to switch off the entire Transmitter in emergency with operation of a single button.

3.9 **INSTRUMENTATION AND INDICATIONS :**

3.9.1 The Transmitter shall be provided with LCD display for fully monitoring the Transmitter operation. All-important parameters required for fault finding should be displayed. These are indications for VSWR, AF input level for each channel, deviation, DC voltage etc. The details of these should be enclosed with tender. Transmitter status and fault conditions shall be indicated by color coded LED's.

3.9.2 Transmitter units shall be provided with Non Volatile Random Access Memory (NV RAM) with Battery Backup to save all parameters when Transmitter is switched – OFF.

3.9.3 Following connectors /socket/ controls shall be provided preferably on Front Panel :

- a) BNC socket for RF Monitor output.
- b) Input level potentiometer of Mono/ MPX signal.
- c) Input level potentiometer of left and right channels.
- d) Output power level potentiometer.
- e) LCD back lighted display.

- f) Navigation buttons to browse / selection/operation of menus with parameter validation button.
- g) LED's for high RF , high VSWR indications.
- h) Input for RS 232 connector. (Optional)

3.9.4 Following connectors /socket shall be provided preferably on Back Panel :

- i. One earthing clip (GROUND).
- ii. Mains input socket with a Start/Stop switch.
- iii. Female N-type socket for RF output.
- iv. Female BNC socket for Multiplex / Mono input.
- v. Female BNC socket for Auxiliary multiplex input.
- vi. XLR socket for Balanced Analog L/ R audio Input.
- vii. BNC socket for 19 kHz and multiplex output.

3.9.5 The Transmitter shall be supplied with a Dummy load of 250 Watts capacity with suitable line sections and shall be mounted in Equipment Rack with suitable RF Feeder Cable.

3.10 COOLING SYSTEM:

Full details of cooling system shall be given. Temperature rise of cooling air for rated power output is to be indicated.

3.11 SPARES : (Optional)

Transmitter : The tenderer shall quote for one set of manufacturers recommended list (MRL) for spares for Transmitter Unit. These shall also include following:

- a) PA transistors
- b) Low power semi conductor devices
- d) PCB's modules
- e) Switches/ Fuses
- f) Discrete items like resistors, capacitors and inductors and control relays.
- g) Spare Modules like PA, Spare power supply unit and control unit.
- i) Blower / Fan with motor.
- j) MOV's for Power supply Unit.
- k) Other miscellaneous items.

Price of each item shall be quoted separately.

SECTION IV
TECHNICAL PARAMETERS OF THE TRANSMITTER

4.1 GENERAL

4.1.1	Frequency Range	87.5 MHz to 108 MHz.
4.1.2	Frequency deviation	\pm 75 kHz (with 1 kHz. 0 dBm input) Capable upto \pm 100 kHz.
4.1.3	Frequency Setting	Direct from front panel in 10 kHz increments.
4.1.4	Class of Emission	180 K FQD&E
4.1.5	Stereo transmissions	According to ITU Recommendations 450-1, Section 2.2 (Pilot tone system).
4.1.6	Pre-emphasis	0, 50, 75 micro seconds (selectable).

4.2 INPUTS

4.2.1	Modulating input	The Transmitter should be able to accept Analog Mono, Analog Stereo signal, Stereo encoded signal, composite signal and Digital AES/ EBU signal. (Additional card/module required if any is to be included)
4.2.2	Input level	-6 to + 6 dBu or better (adjustable)
4.2.3	Input Impedance (Mono)	600 ohm (balanced)
4.2.4	Input Impedance (Stereo)	10 k ohm (unbalanced)

4.3 RF OUTPUT

4.3.1	Output power (RF)	100 Watts, Continuously variable from 10 to 100 watts or adjustable in steps of 10 watts.
4.3.2	OUTPUT Impedance	50 Ohms. (Unbalanced)
4.3.3	Output connector	N (F) connector (Rear)
4.3.4	Permissible VSWR	a. 1.5: 1 on full power; b. Automatic power reduction beyond 1.5:1 . c. Tr. should be protected for short and open circuit conditions.
4.3.5	Harmonic and Spurious Signal Suppression.	Better than - 70 dBc (87.5 to 130 MHz)
4.3.6	Maximum Frequency Tolerance	\pm 300 Hz.
4.3.7	Asynchronous AM S/N ratio	60 dB below equivalent 100% amplitude modulation at 400 Hz. using 75 μ s de-emphasis. (no FM modulation)
4.3.8	Synchronous AM S/N ratio	50 dB below reference Carrier with 100% Amplitude modulation with 75 μ s de-emphasis and 400 Hz. highpass filter (FM deviation \pm 75kHz. sine wave)

4.4 WIDEBAND COMPOSITE OPERATION:

4.4.1	FM S/N ratio at 75 kHz deviation , unweighted (Reference 400 Hz at +/- 75 kHz frequency deviation with 50 micro-sec de-emphasis (30 Hz to 100 kHz Bandwidth.)	Better than 70 dB
4.4.2	Total Harmonic Distortion + Noise	Better than 0.2 %.
4.4.3	Amplitude response (30 Hz to 100 kHz)	Better than \pm 0.5 dB

4.5 MONO OPERATION :

4.5.1	FM S/N ratio at 75 kHz deviation un-weighted with 50 us de-emphasis. (30 Hz to 15 kHz Band Width)	Better than 70 dB
4.5.2	Total Harmonic Distortion (30 Hz to 15 kHz) with 50 us de-emphasis at 100% mod.	Less than 0.2 % including all harmonics upto 30 kHz
4.5.3	Amplitude response (30 Hz to 15 kHz)	Better than \pm 0.5 dB

4.6 STEREO OPERATION :

4.6.1	Stereo separation (sine wave) (30 Hz to 15 kHz)	Better than 50 dB
4.6.2	Stereophonic Cross Talk referred to 100% modulation (30 Hz to 15 kHz)	Better than 50 dB
4.6.3	FM S/N ratio at 75 kHz deviation (30 Hz to 15 kHz), un-weighted with 50 micro-sec. de-emphasis.	Better than 70 dB
4.6.4	Total Harmonic Distortion (30 Hz to 15 kHz) with 50 us de-emphasis at 90% mod.	Less than 0.5 % including all Harmonics upto 30 kHz.
4.6.5	Inter-modulation Distortion (L or R)	Less than 0.2 %.
4.6.6	Audio Amplitude Response (30 Hz to 15 kHz)	\pm 0.5 dB or better.
4.6.7	Pilot Tone Frequency Stability	Better than \pm 1 Hz

4.7 POWER SUPPLY

4.7.1	Operating Line voltage	AC Single Phase : 230 Volts \pm 10 %
4.7.2	Frequency	50 Hz \pm 4%
4.7.3	Power factor	Better than 0.9.
4.7.4	Power Line Harmonics	IEEE 519-1992

4.8 AMBIENT CONDITIONS :

4.8.1	Operating temperature range	0 °C to 50 °C
4.8.2	Relative Humidity	95% non –condensing.
4.8.3	Working altitude	upto 4000 meters AMSL
4.8.4	Cooling	By Fan/ Blower.

SECTION V
**TECHNICAL SPECIFICATIONS OF THE AUTOMATIC CHANGEOVER UNIT,
EQUIPMENT RACK, UPS, ANTENNA AND RF CABLE**

5.1 AUTOMATIC CHANGEOVER UNIT (ACU) :

- 5.1.1 One Automatic Changeover Unit (ACU) for operating the Transmitter in (1 + 1) mode to facilitate automatic switch “ON” of the 2nd Transmitter Unit in case of failure of RF output of 1st Transmitter Unit shall be supplied with each set.
- 5.1.2 Any one of the 100W Transmitter unit shall be selectable as master or slave automatically. Normally one 100W Transmitter shall be “ON” and other transmitter shall be in “OFF” (passive stand by) mode. When the RF power of the 1st transmitter goes down by more than 3 dB, it should be sensed as a failure to switch to second transmitter automatically. In case of failure of the complete system, three trials at interval adjustable up to 10 minutes shall be done before final switch off.
- 5.1.3 The audio shall be fed to both the Transmitter Units from one external source (satellite Receiver Ku band) and therefore, proper arrangement of splitting the audio after due amplification in Changeover Unit and permanent feeding to both the Transmitters shall be made. In case of audio failure, an indication shall be displayed in the front panel of ACU.
- 5.1.4 The complete switching sequence of transmitter and associated equipments may be provided with the technical offer.
- 5.1.5 Arrangement shall be made for bypassing the ACU in case of its failure so as to enable operating personnel to operate the transmitter in the manual mode.
- 5.1.6 Power Supply to the ACU shall be fed through the UPS.

5.2 EQUIPMENT RACK:

- 5.2.1 **General** : The equipment rack will house the 2 nos. of transmitters UPS, and ACU. It shall be a standard 19” Rack conforming to professional standards of sound broadcasting for mounting equipment and accessories having Lockable door and side panels, Front Glass Panel, Vertical Cable Manager. Necessary repeat coils, tag blocks, terminal strips, BNC connectors etc as per requirement shall be provided in the rack for all inputs. 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.
- 5.2.2 **Mechanical**
 - (i) **Construction Details** : The rack shall be sturdily constructed from aluminum extrusions of suitable size fastened to form framework properly reinforced with stiffeners, suitably welded. The front site of the rack shall be open for mounting equipments. The rear side of the rack shall be provided with a single leaf, hinged removable type door and handle with latching

arrangement . The sides should be covered with panels which can be screwed to the frames. These panels should be reinforced with stiffeners. The Racks shall have holes for grouting bolts on the bottom plate. The thickness of the sheet used for sides of the rack and door shall be 1.6mm and 1.3mm respectively. The overall dimensions of the rack shall be within 2120 \pm 5mm (H) x 645 \pm 5 mm (W) x 685 \pm 5mm(D).

- (ii) Mounting Arrangement : Panel mounting rails with pre-drilled and tapped holes corresponding to metric thread 'M-S' are to be provided at the front. Suitable mounting arrangement is to be made at the top and the bottom of the frames for mounting the rails at different intervals. Pre-drilled holes shall be such that it shall be possible to mount any standard equipment of width 483mm and height 1U to 4U. Necessary equipment support angle to relieve strain on holding screws wherever required shall be provided. Any equipment which is not of standard 19" width shall be provided with rack mount kit.
- (iii) Style/Strips or Trims : To render sleek look style, strips/trims are to be provided on the front side which will cover the drilled and holes on the mounting rails.
- (iv) Ventilation Arrangement : Louvers are to be provided throughout the length of rear door of the rack. provision is required to be made for mounting a cooling fan of minimum 100 CFM at the top. Separate cooling system for UPS at the bottom of the rack shall be provided.
- (v) Finish of the Rack : The inside and outside of the rack shall be spray painted with dark admiralty grey (Color No.632 of IS-5 as amended up to date) after necessary anti rust treatment.

5.2.3 Jack Field/ Audio path Panel :

- a. Standard Jacks of robust construction and positive action shall be used. Input and output of all the equipments and the programme lines shall be brought to the Jack Field. Few jack points shall be used as check points without disrupting the signal flow & few to be left as spares for the tie lines, parallel points and for future use. The jack strip panels shall be open able on front sides without strain on connector and wiring. Jacks shall be of "Switch craft" make or equivalent.
- b. Jack construction: The jacks shall have preferably a nickle plated brass frame, with nickle-silver springs and gold-silver/ Palladium contacts. The jacks shall be mounted on 20mm centers. The Jacks shall be as per DIN specifications.
- c. Contact arrangement : Each jack shall be a five point jack, providing a break circuit (on both wires) and an isolated earthing lug.
- d. Indicating strip: A paper-strip covered with transparent plastic shall be provided above the row of jacks for labelling purposes.

5.2.4 Programme Meter (PPM/VU)

The Program Meter shall preferably be a dual VU meter or Bar graph Display with LEDs or both. The signal fed at the input connectors shall be processed,

levels compared and displayed on the Bar graph. This unit shall work independently in any configuration for signal monitoring without loading the source. There shall be provision for selecting VU or Peak response using a front panel switch.

5.2.5 Loud Speaker Panel

The Loud Speaker Panel shall have two loud speakers of 6" size, one for each channel. The output from the Receivers will be fed to the loudspeakers. The loudspeaker impedance shall be 8 ohms. The loudspeakers shall be of reputed make similar to Philips.

5.2.6 Repeat Coil:

- (i) A Line to line audio transformer shall be provided for isolating balanced and unbalanced circuits.
- (ii) Primary & Secondary Impedances : The primary secondary windings shall consist of two exactly identical sections which can be connected in series for 600 ohms operation or in parallel for 150 ohms operation.
- (iii) Hum reduction : The shielding and design of the windings shall be such that the hum level picked up by the unit, when placed in normal magnetic field inside equipment racks is better than -75dBm, as measured across either winding, both secondary and primary being terminated by 600ohms.

5.2.7 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 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 in order 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.

5.2.8 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 shall be provided for keeping patch cords & headphones.

- (v) Suitable arrangement is to be made for mounting AIR Monogram on the top frame on the front side.
- (vi) Two 2U blank space shall be provided for fixing Satellite Receivers.
- (vii) Blank panels of 1U height wherever required for proper gap between equipment are to be provided suitably.

5.2.9 **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. The Rack shall also be provided with two additional sockets of 3 pin, 5A for AC Power supply input to the equipment. Blank Space is to be provided in the rack for mounting other equipment, if any.

5.2.10 **Earthing :**

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

5.2.11 **Shielding:**

The Rack shall be installed in the transmitter Hall. Necessary precautions shall be taken to shield the equipment and wiring from high level R.F. field.

N.B.: The Tenderer shall prepare schematic drawing & layout of equipment in the offered Rack and submit along with tender.

5.3 **Uninterrupted Power Supply System (UPS):**

The input power to the transmitter system is supplied from an external 230 V Single – phase system of at least 2.0 KVA Capacity.

Two nos. of 1000 VA, **ISO 9001 certified** On-line UPS are to be provided in **hot standby (1+1) mode** to maintain power to the selected transmitter and other equipment with Maintenance Free Batteries with each set. In case one UPS fails the second UPS shall take full load of equipment to sustain broadcast service. 1000 VA On- Line type UPS (hot standby mode) shall conform to the following Specifications.

S. No.	Parameters	Specifications
5.3.1	Input	180 – 260 Volt AC, 50 Hz Single Phase
5.3.2	Output	230 Volt AC \pm 1 %.
5.3.3	Capacity	1000 VA
5.3.4	Efficiency	> 90%
5.3.5	Indications and Protections	Self-diagnostic, Spike Suppressor, Electronic overload protection.
5.3.6	Isolation Transformer	Internal in-built
5.3.7	Battery capacity	i) Capacity 30 minutes on full load ii) Minimum 720 VAH
5.3.8	Web monitoring hardware with software	Optional

5.4 ANTENNA

5.4.1 One No. of VHF FM Antenna along with mounting arrangement shall be supplied with each set.

5.4.2 The Antenna will be top side mounted on Guyed Mast / Self Supporting tower of 30 mtr. height or on a Pole to be provided by AIR.

5.4.3 Following documents shall be supplied along with the Tender:

- a. VSWR curve for complete Frequency range.
- b. Horizontal Radiation Pattern.
- c. Vertical Radiation Pattern

5.4.4 Brief Specifications of the Antenna be supplied are given below:

S. No.	Parameters	Specifications
5.4.4.1	Frequency Range	87.5-108 MHz, Band II, Wide band
5.4.4.2	Impedance	50 ohms unbalanced
5.4.4.3	VSWR continuous range	Better than 1.2 : 1 (Over 10 MHz bandwidth in a defined Freq. Range in VHF Band - II)
5.4.4.4	Power Handling capacity (Total)	\geq 500 Watts
5.4.4.5	Polarization	Circular
5.4.4.6	Gain w.r.t. Half Wave Dipole	0 dBd
5.4.4.7	Lightening Protection	All metal parts to be DC grounded.
5.4.4.8	Branches and Clamps for mounting Dipoles	Suitable Branches and Clamps to be supplied with the Antenna.
5.4.4.9	Termination	Suitable for RF Feeder cable connections

S. No.	Parameters	Specifications
5.4.4.10	Mounting of Antenna	All the required hardware for mounting of the antenna shall be supplied along with the Antenna. The cross-sectional size of Tower/Pole will be intimated at the time of placement of the Order.
5.4.4.11	Maximum Wind Speed	160 km/Hour
5.4.4.12	Ambient Temperature	-20°C to 50 °C
5.4.4.13	Humidity	95% non-condensing
5.4.4.14	Rainfall	Moderate to heavy.
5.4.4.15	Ice Protection	Randomized connector
5.4.4.16	Spares	As per recommendation of manufacturer.

5.5 RF CABLE:

5.5.1 The Coaxial **RF Cable** for feeding to Antenna with suitable connectors shall be supplied with each transmitter. The Transmitter shall be connected to the Antenna via a 7/8" foam type RF Co-axial Cable.

5.5.2 The cable shall be complete with end connectors, hoisting grips and cable clamps for its hoisting.

5.5.3 Specifications:

5.5.3.1	Center Conductor	Copper Tube
5.5.3.2	Dielectric	Foamed Polyethylene (SPE)
5.5.3.3	Size of the cable	7/8 "
5.5.3.4	Operating Frequency Range	87.5-108 MHz
5.5.3.5	Impedance	$50\Omega \pm 1\%$
5.5.3.6	Outer conductor material	Corrugated copper
5.5.3.7	Power Handling capacity at 100 M Hz.	≥ 5 KW
5.5.3.8	Attenuation at 100 MHz.	≤ 1.5 dB / 100 mtr.
5.5.3.9	Insulation Resistance	≥ 5 Tera Ω m
5.5.3.10	Weight	≤ 60 Kg/ 100 m
5.5.3.11	Tensile Strength	≤ 1400 N
5.5.3.12	Ambient temperature	-25 °C to 60 °C
5.5.3.12	SPARES	To be quoted as per recommendation of manufacturer.

TESTING DETAILS OF ADVANCE SAMPLE

The Field trial/sample Testing for acceptance of the Transmitter system will be carried out at AIR site at New Delhi before ordering complete quantity. All facilities like complete set of measuring instruments, power supply, manual assistance, etc. will be provided by AIR. Complete details and specifications of the Transmitter will be checked and all parameter values will be measured.

Operation checking of the Transmitter Unit and measurements on the Transmitter shall be carried out at three different frequencies in the VHF band 87.5 to 108 MHz as per mutually agreed ATP. Transmitter shall also be tested for heat run for continuously 24 hours.

Exhaustive operation/checking/measurements will be carried out so as to completely check the compliance of the Transmitter and other Equipments in the Equipment Rack with the requirements as projected in the specifications. It is mandatory that all parameters are checked, measurements are carried out in advance also at factory and these details, notes and figures are available alongwith the sample Unit supplied for inspection. Following information should also form part of data which will also be checked for sample Transmitter Unit during field trial/testing:

1. Make and type of Transmitter and accessories.
2. Dimension of Transmitter, sub-units and accessories.
3. Working/operation of all sub-units and accessories.
4. System configuration check for completeness of Transmitter.
5. Checking meter readings and calibration.
6. Measurements of all parameters as per item nos. 4.1 to 4.7 of Section IV of specification. All the parameters will be measured on any 3 different frequencies in the VHF FM band.
7. Checking of control/protection system of Transmitter.
8. Checking of all power levels, meters, LCDs etc.
9. Measurement of levels in the whole AF and RF chain.
10. Checking of RF voltages on test points.
11. Inter- change ability of PA, sub-modules and PCBs.
12. Remote control operation checking (Optional).
13. Exciter operation, checking and measurements.
14. Checking of Automatic Changeover Unit for different modes of operation.
15. Checking of UPS in (1+1) mode and its back up time.

INSPECTION DETAILS

The Inspection for acceptance of the Transmitter Units will be carried out at the Works of the Manufacturer/System Integrator. All facilities like complete set of measuring instruments, power supply, manual assistance, etc. will be provided by the supplier without any additional charges. Complete details and specifications of the Transmitter and other Equipment will be checked and all parameter values will be measured.

Total 10% of randomly selected transmitter set shall be inspected in details. Operation checking of the Transmitter and measurements on the first Transmitter selected at random shall be carried out at three different frequencies in the VHF band 87.5 to 108 MHz as per mutually agreed ATP. The remaining transmitters shall be tested at single frequency. Transmitter shall also be tested for heat run for continuously 24 hours. Complete set of instruments will be made available in advance and the list of these measuring instruments along with their set ups may be forwarded along with the ATP.

Exhaustive checking/measurements will be carried out so as to completely check the compliance of the Transmitter and other Equipments with the requirements as projected in the specifications. It is mandatory that all parameters are checked, measurements are carried out in advance and these details, notes and figures are available at the factory/Supplier Works at the time of inspection. These performance reports shall also be submitted to All India Radio before inspection.

Following information should also form part of above data which will also be checked for each Transmitter Unit during inspection by indenter's representative at Manufacturer/System Integrator 's works: -

1. Make and type of Transmitter Units, accessories and spares.
2. Dimension of Transmitter, sub-units and accessories.
3. Working/operation of all sub-units and accessories.
4. System configuration check and completeness of Transmitter.
4. Checking meter readings and calibration.
5. Measurements of all parameters as per item nos. 4.1 to 4.7 of Section IV of specification. All the parameters will be measured on any 3 different frequencies in the VHF FM band.
7. Checking of control/protection system of Transmitter.
8. Checking of all power levels, meters, LCDs etc.
9. Measurement of levels in the whole AF and RF chain.
10. Checking of RF voltages on test points.
11. Inter- change ability of PA, sub-modules and PCBs.
12. Remote control operation checking.
13. Exciter operation, checking and measurements.
14. Checking of all spares, PCB's, modules for the respective transmitter.
15. Checking of operation of UPS, Changeover Switch, Automatic Changeover Unit for different modes of operation.