प्रसार भारती/Prasar Bharati
(भारत का लोक सेवा प्रसारक)
(India's Public Service Broadcaster)
आकाशवाणी महानिदेशालय /Directorate General: All India Radio
योजना एवं विकास एकक, आकाशवाणी भवन, संसद मार्ग, नई दिल्ली-110001
P & D Unit, Akashvani Bhawan, Sansad Marg, New Delhi-110001
[एफ. एम. डिजाईन अनुभाग /FM Design Section]
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File No. Specification-20kWFMTx-9/4/2022-D (TD/FM) Dated 26.08.2022

**Subject:** Specifications for supply of 20kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit and associated equipments/items for use anywhere in India as transmitter setup -**regarding Industry feedback & Budgetary quotes**

DG: AIR is planning for procurement of supply of 20kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit and associated equipments/items for use anywhere in India as transmitter setup, on open tender basis. Draft technical specification is enclosed for reference.

The last date for submission of budgetary quote & industry feedback has been extended **up to 05.09.2022. No further extension shall be entertained.**

Industry feedback (if any) and budgetary quote may be sent to this Directorate at the following e-mail addresses.
murugan_k@prasarbharati.gov.in
sandeepsingh@prasarbharati.gov.in
manzoor@prasarbharati.gov.in
yogendraair@prasarbharati.gov.in

Encl: As above.

(मंजूर अली/Manzoor Ali)
सहायक निदेशक (अभि.)/Assistant Director (Engg.)
कृते महानिदेश /For Director General

To:

1. Prasar Bharati web-site
2. The Prospective Bidders
3. DDG (E-Purchase), P&D Unit, DG: AIR, New Delhi

कृते महानिदेश/For Director General

**PRASAR BHARATI**
**(BROADCASTING CORPORATION OF INDIA)**
**DIRECTORATE GENERAL; ALL INDIA RADIO**
**(PLANNING & DEVELOPMENT UNIT)**
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# Specifications for Supply of 20kW Digital Compatible (HD Radio & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit and associated equipments/items for use anywhere in India as transmitter setup

## SUMMARY



## A. ESSENTIAL REQUIREMENTS FOR TENDER:

1. (i) The tenderer should submit Schedule of Requirements/Materials of Supply (un-priced) ***in the same format as given in Section-V (A&B)*** of AIR Specifications in the technical bid, failing which the tender shall be considered incomplete and is liable to be rejected.

   (ii) It is also mandatory to mention ***Make & Model of the offered equipment*** in the Schedule of Requirements/Materials of Supply, failing which the tender shall be considered incomplete and is liable to be rejected.

   (iii) Make/Model and detailed specifications of the equipments/items being offered shall be mentioned categorically, to access the full merit of the offer, failing which tender shall be considered incomplete and is liable to be rejected. Boarder terms **viz. Equivalent/similar** will not be accepted.

2. Each statement of this specification has to be complied with & supported by printed technical literature, technical data sheets, schematic drawings and technical manuals from the OEM (Original Equipment Manufacturer) by the tenderer, to assess the merit of the offer without which the tender will be considered incomplete and is liable to be rejected.

3. The tenderer should submit the tender offer to AIR (All India Radio) in the format given below, section wise & clause wise, in respect of all the sections of technical specifications. The OEM/tenderer must provide the page number reference, in column (4) of the table given below, of the Technical bid clearly indicating the volume number also, if any, for each supporting document to verify the parametric values shown in the technical specifications compliance statement, to assess the full merit of the offer, failing which tender shall be considered incomplete and is liable to be rejected.

| S. No. of AIR Specifications (Section wise & Clause wise) (1) | Details of AIR Specifications (Part/ Section wise & Clause wise) (2) | Compliance **(Yes/No)** (3) | The page No. of the tender offer, where the information/ supporting document is available. (4) | Remarks (5) |
|---|---|---|---|---|
| A. Essential requirements for tender | | | | |
| B. Essential eligibility criteria for tenderers | | | | |
| Section-I Clause wise | | | | |
| Section-II Clause wise | | | | |
| Section-III Clause wise | | | | |
| Section-IV Clause wise | | | | |

4. The tenderer should quote the rate/cost of individual items in the tender offer while submitting the tender offer for spares **(OPTIONAL)** in commercial bid. ***Optional items will not be considered for ranking purpose.***

5. The complete technical specifications (Section wise & Clause wise) compliance statements along with Schedule of Requirements/Materials (un-priced) must be signed & stamped by the respective Original Equipment Manufacturer (OEM) in the tender document, failing which the tender shall be considered incomplete and is liable to be rejected.
   In case tender offer is from other than the Original Equipment Manufacturer, the tenderer must also sign & stamp the complete Technical specifications (Section wise & Clause wise) compliance statements, failing which the tender shall be considered incomplete and is liable to be rejected. The OEM & tenderer should mention their name in CAPITAL LETTERS & designation of the signatories, full address with pin code, phone number, fax number, e-mail addresses etc.

6. All the volumes of the entire technical bid must be page numbered.

7. The authorization and guarantee must be given by respective Original Equipment Manufacturer (OEM) on their letter head pad duly signed & stamped. In case tender offer is from other than the Original Equipment Manufacturer, the tenderer must also give guarantee on their letter head pad duly signed & stamped, failing which the tender shall be considered incomplete and is liable to be rejected. Guarantee shall be as per the format given in AIR specification.

8. In case tender offer is from other than the Original Equipment Manufacturer, the tenderer should also furnish a certificate from the OEM that the tenderer can quote items of the OEM directly, failing which the tender shall be considered incomplete and is liable to be rejected without any notice/back reference.

9. Any change in the AIR technical specifications format or language or in parameters or of any other nature including the deletion/addition of technical specifications clause, words, lines in the technical specifications compliance statement by the OEM/ tenderer will not be acceptable to AIR and the tender is liable to be rejected.

10. Prasar Bharati will follow the reciprocal market access strategy of the Government of India, which describes on the Clause 10(d) of Public Procurement Preference to Make in India, Order 2017. The Purchaser shall have right for not to consider any Bid and may restrict such Bidders from the bidding process; who originate from those countries, where they do not allow market access for Indian companies; in such cases, the Clause 10 (d) of Public Procurement Preference to Make in India, order 2017, shall be invoked wherever applicable, when it is relevant.

11. Amendment in General Financial Rules (GFRs), 2017-Golobal Tender Enquiry issued vide F. No. 12/17/2019-PPD dated 15.05.2020 of Government of India, Ministry of Finance, Department of Expenditure, Public Procurement Division shall be applicable.

## B. ESSENTIAL ELIGIBILITY CRITERIA FOR TENDERERS:

(a) The tenderer shall be from India only.

(b) The tenderer should either be the OEM of VHF FM transmitters/TV transmitters/AM Transmitters or their authorized representative/dealer in India.

(c) In case the tenderer is the authorized representative/dealer, the tenderer must be an authorized representative/dealer of any OEM of VHF FM transmitters/TV transmitters/AM Transmitters of power not less than 5kW for last **three years or more OR** must be in the business of sales and supply of VHF FM transmitters/TV transmitters/AM Transmitters of power not less than 5kW for last **three years or more**. Documentary evidence to support this must be provided.

(d) (i) The OEM of the transmitter must have an experience of manufacturing and supplying VHF FM transmitters of power output not less than 20kW for at least last 10 years. Documentary evidence to support this must be provided.

(ii) The OEM should have supplied FM transmitters to reputed/public broadcasters. The OEM must provide the details of past supply record (**in the format given below)** for at least 10 Nos. of such offered FM transmitters of power output not less than 20kW, supplied during last 5 years ending last day of the month previous to the one in which the tender is invited. Documentary evidence to support this must be provided.

| Supply order No. with date | Transmitter Model | Transmitter Power Output | Qty. supplied | Name of the broadcaster with full postal address including e-mail address to whom transmitter was supplied. | Remarks |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| | | | | | |

(iii) All India Radio reserves the right to get performance feedback of the transmitters from any of the above broadcasters named by the tenderer/OEM.

(iv) Copies of supply order/Completion certificates/delivery challans/invoice of at least 05 Nos., out of the 10 Nos. of FM transmitters submitted by the tenderer in above format, are also to be enclosed by the tenderer.

(e) The OEM of the offered VHF FM transmitter must have his local office/authorized representative/dealer in India for after sales support. **A certificate as per Annexure-III** duly signed by the OEM as well as local office/authorized representative/dealer must be submitted with the offer. Copy of Agreement/MoU executed between OEMs and their authorized representative/dealer duly signed by both must also be submitted with the offer.

## SECTION-I GENERAL

**THE BROAD SCOPE OF THE SPECIFICATIONS IS AS FOLLOWS:**

**1.0 General Scope:**

The specifications is for Supply of 20kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit and associated equipments/items for use anywhere in India as transmitter set up.

The 20kW Digital Compatible VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover control unit and all associated equipments/items as per Section-V(A & B) shall be capable of continuous round the clock operation.

Transmitter and associated equipments/items shall be field proven for satisfactory operation.

**The following are excluded from the scope & will be provided by AIR:**

i. Construction of necessary buildings, all masonry works & materials connected therewith, masonry foundations, cable trenches & under floor ducts etc. (Dimensions for which are to be furnished by the transmitter supplier, if any).
ii. Power supply connection for the transmitting equipment at a single point.
iii. Furniture & fittings not forming a part of the transmitter equipment.

**1.1 Broad Scope of Supplies:**

**Major Equipments/items to be included:**

| S. No. | Description of Equipments/items |
|---|---|
| 1. | 20kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit |
| 2. | Dummy Load |
| 3. | Motorized RF Coaxial Changeover Switch |
| 4. | RF Coaxial Copper Rigid Lines |
| 5. | Thru line power meter (s) |

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

**1.3 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, measures and quantities shall be in **SI units**.

**1.4 DOCUMENTS/INFORMATION TO BE SUPPLIED WITH THE TENDER OFFER:**

**1.4.1** The complete technical specifications (Section wise & Clause wise) compliance statements alongwith Schedule of Requirements/Materials (un-priced) duly signed & stamped by the respective Original Equipment Manufacturer (OEM) and countersigned by the tenderer as per the format given above in clause A (3), **to assess the full merit of the offer, without which the tender offer will be considered incomplete and is liable for rejection.**

**1.4.2.** Complete printed technical literature/technical data sheet/schematic drawings/detailed information including Technical Manual (for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description and fault diagnosis) of 20kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter in (1+1) configuration and associated equipments/items as per Section-V(A&B) from the respective Original Equipment Manufacturer (OEM) in support of compliance statement should be furnished, **to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

**1.4.3.** Detailed Schedule of Requirements/Materials (un-priced) for the supply of 20kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter in (1+1) configuration and associated equipments/items for each site should be in conformity with Section-V(A&B) without any change in the format, **failing which the tender will be considered incomplete and is liable for rejection. The tenderer must quote all items.**

**1.4.4.** Descriptive information and complete details of each equipment offered shall be given by the tenderer.

**1.4.5.** Country of Origin, Make, Type & Model of all the offered items should be mentioned including the name & address of their vendors.

**1.4.6.** The performance figures of the offered equipment/items must be given by the tenderer**, to assess the merit of the offer, without which the tender will be considered incomplete and liable to be rejected.**

**1.4.7** A copy of Technical Manuals {for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}, must be enclosed with technical bid for assessing the transmitter system. The Technical Manual must include at least the details given below: **Tenderer may please note that AIR shall not be asked by the tenderer to sign any non-disclosure certificates/agreements in any aspects.**

**(a) The Installation Manual must describe the following information:**

(i) A detailed write up in English only regarding VHF FM transmitter system along with its associated equipments/items.

(ii) Diagrams showing the isometric view of VHF FM transmitter and associated equipment with dimensions in metres/mm.

(iii) The procedure of alignment and adjustment of various assemblies & sub-assemblies of VHF FM transmitter such as Exciter, PA, Control Circuit, output stage etc.

(iv) **All *Do's and Don'ts* which are essential for safe installation of the transmitter system.**

(v) An inter-wiring diagram for all transmitter units/modules installed in the transmitter rack,

input/output to transmitter and interlocks with external units and accessories like dummy load, changeover switches, patch panel etc. which are wired in the transmitter interlocks.

**(b) Operation, Maintenance & Servicing Manual must describe the following:**

(i) General description of the offered VHF FM transmitter, transmitter block diagram/schematic drawings indicating the details of different blocks, modules and redundancy incorporated in transmitter and its subsystems.

(ii) Details regarding Digital Compatible of the offered VHF FM transmitter for HD Radio and DRM+ mode for future up-gradation with block diagram/schematic drawings.

(iii) General description and structural overview of the transmitter racks indicating the position of different modules, units, power distribution etc.

(iv) Colour Photographs of transmitter showing the following:
- (a) Front, Rear and Top view of the transmitter.
- (b) Front and rear view of PA, Exciter & Control Unit.
- (c) View of PA with cover opened showing full view of Pallets/RF Boards, various adjusting pots and field replaceable parts.
- (d) Enlarged open view of PA showing at least two RF transistors and bias adjustment pots etc.
- (e) Open view of Exciter Unit.

(v) Screen shots of various display screens showing monitorable and measurable parameters of transmitter.

(vi) A detailed description of working of circuits with all relevant circuit diagrams (components, parts of circuit diagrams will be co-related with circuit description provided) of the complete transmitter system should be provided with details of test points.

(vii) The details of all electrical circuits in various stages of the transmitter used along with their detailed write-ups.

(viii) General description of **RF signal flow diagram for complete RF chain from exciter to filter output with information about power level at input & output of each stage. Losses and gains in various stages including power dividers, combiners, etc. must also be shown.**

(ix) Description of transmitter interlocks, protections under abnormal conditions and schematic drawing indicating interconnections to different transmitter units, external units and accessories like dummy load, changeover switches, patch panel etc. which are wired in the transmitter interlocks.

(x) Details and schematic drawings of cooling system with description.

(xi) Details and schematic drawings of remote monitoring and control facilities of the transmitter along with screen shots of the interface displays. The transmitter parameters that can be remotely monitored and controlled.

(xii) General description of transmitter control system, schematic drawing(s) for control signal distribution including pin details of relevant connectors.

(xiii) General description of exciter unit, block schematics showing details of all sub units, Exciter front and rear views indicating all inputs, outputs and interfaces.

(xiv) General description and architecture of Power Amplifier's block schematic drawings, Front and rear views indicating all inputs, outputs and interfaces.

(xv) Description of measurement of DC voltages, currents and RF power of PA.

(xvi) Description of protection mechanism against high VSWR, overload, high temperature of the exciter, Power Amplifiers and transmitter system.

(xvii) Description of VSWR/temperature foldback alongwith range of foldback. The explanation of foldback with the help of circuit diagram.

(xviii) Details of splitter and combiner system's schematic drawings used in the transmitter.

(xix) Description of various interfaces, connectors, connecting cables and accessories used in the VHF FM transmitter.

(xx) A complete list of all parts/transistors/ICs/components (alongwith part numbers of OEM of the components) used in the transmitter.

(xxi) The make and number of LDMOS/MOS devices used in the power amplifier must be mentioned clearly.

(xxii) Technical data sheet of all high power RF devices/RF components used in the transmitter.

(xxiii) Procedure for changing the frequency of operation of the transmitter.

(xxiv) The detailed procedure and possibilities of by-passing control circuit with diagrams.

(xxv) The description of manual operation of control system including cooling system.

(xxvi) All the screen shots of display of control unit in sequential manner for operation, monitoring and control of each unit viz., Exciter, PAs, cooling systems, power supply, various settings in software etc.

(xxvii) **All *Do's and Don'ts* which are essential for safe Operation & Maintenance of the transmitter.**

(xxviii) Various test fixtures and accessories required for the maintenance/repair of the VHF FM transmitter.

(xxix) The detailed procedure for troubleshooting of the VHF FM transmitter preferably up to component level.

(xxx) The systematic troubleshooting /fault tree and flow diagram should be provided for diagnosis of the faults with their remedial measures.

(xxxi) General description of electrical power distribution and schematic drawing of power supply system used for the transmitter system.

**1.4.8 List of equipment for which respective OEMs' compliance statements, guarantee certificates and certificates for authorization for after sales support is required:**

(i) Transmitter including automatic changeover unit
(ii) Dummy Load
(iii) Thru line power meter (s)
(iv) RF coaxial copper rigid lines & accessories
(v) Motorized RF coaxial changeover switch

All the above documents are necessarily to be provided on respective OEMs' letterhead, duly signed by authorized signatory of the OEM with name and designation of authorized signatory. The documents must have clear reference of item being offered by the respective OEMs.

**1.4.9 In addition to above, the tenderer is also required to submit the document (s)/information as asked elsewhere in the technical specifications, to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

**1.5 DOCUMENTS/INFORMATION TO BE SUPPLIED BY THE TENDERER WITHIN 15 DAYS AFTER ISSUE OF ACCEPTANCE OF TENDER:**

One set of **Technical Manuals** {containing all the details as in 1.4.7(a) & (b) for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}, **COLOUR** printed and duly bound, for 20kW Digital Compatible VHF FM transmitter in (1+1) configuration, Automatic Changeover Unit (ACU), Dummy Load, Thru Line power meter, Motorized RF coaxial changeover switch, RF coaxial copper rigid line, Remote Monitoring & Control facility etc. along with one soft copy on pen drive must be supplied to "The DDG (E-FM), P & D Unit, DG: AIR, New Delhi-110001", **for examination and approval**.

**1.6 INFORMATION TO PRECEDE DESPATCH OF EQUIPMENT:**

Following information should be supplied to The DDG (E-FM), P & D Unit, DG: AIR and each of the consignees prior to dispatch of equipment:

a) Detailed list of equipments under dispatch.
b) Photograph showing location of various units/subunits with item numbers marked thereon.

**1.7 DOCUMENTS/INFORMATION TO BE SUPPLIED ALONG WITH EQUIPMENT:**

Technical Manuals (duly approved by AIR) {containing all the details as in 1.4.7(a) & (b) for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}, **COLOUR** printed and duly bound, for 20kW Digital Compatible VHF FM transmitter in (1+1) configuration, Automatic Changeover Unit (ACU), Dummy Load, Thru Line power meter, Motorized RF coaxial changeover switch, RF coaxial copper rigid line, Remote Monitoring & Control facility etc. and inspection report shall be supplied as per the details given below:

(i) For Consignee- 2 Sets of technical manual in hard copies printed and duly bound alongwith one soft copy on pen drive.
(ii) For the following Offices/Officers-One Sets of technical manual in hard copy printed and duly bound alongwith one soft copy on pen drive for each respective offices/officers:
DDG(E-FM), DDG(E-TM), Zonal Office (Maintenance Wing of NZ, SZ, WZ, NEZ & EZ), Zonal Office (Project Wing of NZ, SZ, WZ, NEZ & EZ), Technical Library(P&D Unit), R&D & NABM (T)

**1.8 DELIVERY:**

Supply will have to be completed within **SIX MONTHS** from the date of Acceptance of Tender or **FIVE MONTHS** from the date of the Decision Letter from WPC(wherever is required) in respect of RF equipment, provided by AIR, whichever is later.

**1.9 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. The copies of packing slips and other details should be sent separately to respective consignee and also to DDG (E-FM), P & D Unit, DG: AIR, New Delhi.

**1.10 INSURANCE AND MARINE RISKS ETC.**

Please refer to commercial terms.

**1.11 GUARANTEE**:

The tenderer shall submit with his offer an undertaking to accept the following guarantees:
*{This Guarantee clause is applicable to Transmitter as well as all the associated equipments/items mentioned in Schedule of Requirements/Materials (un-priced)}.*

(i) 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.
(ii) A guarantee to make good within **15 days** (from the date of first intimation to OEM/tenderer) at tenderer's expense any component which becomes defective under normal operating conditions for **36 months** from the date of supply. If the tenderer failed to rectify the fault within the stipulated period of 15 days, the guarantee period for that particular equipment/item would be extended corresponding to

the outage period.

(iii) A guarantee to supply all components for a period of **10 years** from the date of supply, at rates at which these are being supplied by the firm to other customers and also should match prices of original manufactures of these components prevailing at that time.

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

## 1.12 PRE-DISPATCH INSPECTION OF TRANAMITTER & ASSOCIATED EQUIPMNTS/ITEMS:

The complete Acceptance Test Procedure/Protocol (ATP) will be prepared by the respective OEM of the offered equipments/items and submitted to DDG (E-FM), P&D Unit, DG: AIR for approval within **15 days** of issue of Acceptance of Tender. ATP will also indicate full details of setup for measuring/testing equipments to be deployed during the performance measurements/inspection. The approved ATP shall form the basis for performance measurements/inspection to be carried out. AIR has the right to include other technical parameters in ATP submitted by OEM within the ambit of specification of the product offered.

**(A). INSPECTION OF TRANSMITTERS:**

a). Detailed Pre-dispatch Inspection (PDI) of transmitters on dummy load will be carried out at OEM's Works Place by **two Engineers** of All India Radio as per details given in **Annexure-I.**

b). Call for Pre-dispatch Inspection (PDI) is to be given by the tenderer to All India Radio at least **6 weeks** in advance from the date of PDI. Testing/measurement reports as per approved in ATP along with approved copy of Technical Manual (s) must be submitted to All India Radio along with the call for inspection of transmitters for analyzing etc. within **20 days** from the date of approval of draft ATP These testing/measurement reports and approved copy of Technical Manual (s) must also be available at the time of inspection of the transmitters.

c). Inspection period will be two days for each Set (1+1) transmitter and two additional day to test the compatibility of the transmitter for HD Radio or DRM+ mode and endurance test.

d). For AIR inspecting engineers, expenses toward to and fro air journey, boarding, lodging etc. will be borne by All India Radio.

**(B). INSPECTION OF ASSOCIATED EQUIPMENT/ITEMS:**

a). All other associated equipments/items like Dummy Load, Thru line power meter, RF coaxial copper rigid lines & accessories, Motorized RF coaxial changeover switch etc. will be accepted on the basis of Original Equipment Manufacture's (OEM) Test Certificates, duly signed and stamped by OEM. The approved ATP shall form the basis for performance measurements/OEM test certificates.

b). These OEM test certificates duly stamped and signed by OEM in respect of all equipments/items as per approved ATP are to be submitted by the tenderer to AIR along with the call for inspection of transmitters for analyzing etc. These OEM test certificates must also be available at the time of inspection of the transmitters.

## 1.13 TRAINING:

a. OEM's Engineer(s) shall train about **20 AIR Engineers** for **5 working days** at any one of AIR sites / Delhi within six months after supply, to enable them to become acquainted with all particulars as well as installation, operation, maintenance, trouble shooting of the transmitter and associated equipments at no cost to AIR. However, AIR shall bear all touring expenses of AIR Engineers deputed for training and the same is not to be included by the tenderer in their offer.

b. The training shall cover theoretical concepts, demonstration of salient features, configuration of transmitter, operational, maintenance & servicing, fault finding, circuit tracing, component/ module replacements, trouble shooting, preventive maintenance, remote control operation and other relevant topics etc. related to the transmitter.
c. Training material in hard and soft copies are to be provided by the OEM to each AIR engineer undergoing the above training.
d. **Colour printed & duly bound** two sets of training lecturer notes, schematic drawings, hand books etc. shall be supplied to DDG (E-FM), P&D Unit, DG: AIR before commencement of training.

## 1.14 ESSENTIAL REQUIREMENT FOR LOCAL OFFICE/AUTHORIZED REPRESENTATIVE/ DEALER IN INDIA FOR AFTER SALES SUPPORT:

(a) The OEM should have complete setup for maintenance/repair of the transmitter in India, either of its own or through local office/authorized representative/dealer.

(b) The local office/authorized representative/dealer will be the nodal point for resolving issues related to after sales support. It is the responsibility of local office/authorized representative/dealer to arrange the repair/replacement of faulty items. Any module of transmitter or other equipment requiring repairs will be repaired. If it is not feasible to repair the module at site, the same will be collected from the site by local office/authorized representative/dealer and will arrange repairs locally. The cost of transportation, repairs etc. shall be borne by the tenderer during the guarantee period.

(c) After sales support for the repairs/maintenance of transmitter system after the completion of guarantee period, shall also be provided by the respective OEM of the transmitter and other associated equipments through their local offices/authorized representatives/dealers in India.

(d) The details of technical facilities available with local office/authorized representative/dealer **for after sales support such as test bench, necessary test & measuring equipment and photographs thereof, must be provided in the technical bid**.

(e) At the discretion of AIR, the representative(s) of AIR may visit the works of local office/authorized representative/dealer of OEM in India to ensure/verify that adequate technical infrastructure is available for after sales service for timely resolving the issues related to attending/replacing the equipments. Tenders from the tenderers who failed to meet these criteria shall be considered incomplete and is liable to be rejected.

## 1.15 SPARES (Optional):

(a) The minimum recommended essential spares as per Section-V(B) and any other critical spares suggested by the OEM, required to maintain the continued service of the transmitter in a reliable manner, shall be quoted by the tenderer.
(b) The minimum recommended essential spares may be based on predicted rate of failure.
(c) In case, the tenderer quotes the optional items as 'a set', the details of the components/items offered in the 'set' must be spelt out clearly including their Make & Model and quantity, failing which the tender offer is liable to be rejected.
(d) All India Radio at its own discretion may procure essential spares for a value not exceeding 10% of the cost of equipments. The tenderer should quote all the essential spares.

## 1.16 ENVIRONMENTAL CONDITIONS FOR TRANSMITTER AND ALL ASSOCIATED EQUIPMENT:

| | | |
|---|---|---|
| Ambient temperature range for operation | : | 0º C to + 45º C |
| Relative humidity | : | 95 percent, non-condensing |
| Working altitude | : | Up to 2000 meters AMSL |

## 1.17 POWER SUPPLY FOR THREE PHASE EQUIPMENT:

| | | |
|---|---|---|
| Operating Line Voltage | : | AC Three phase, 4 wire, 400V ± 10 % |
| Frequency | : | 50Hz ± 4 % |
| Power Factor | : | Better than 0.9 |

## 1.18 POWER SUPPLY FOR SINGLE PHASE EQUIPMENTS:

| | | |
|---|---|---|
| Operating Line Voltage | : | AC Single phase, 230V ± 10 %, |
| Frequency | : | 50Hz ± 4 % |
| Power Factor | : | Better than 0.9 |

## 1.19 SUMMARY OF THE TIMELINES:

| | | |
|---|---|---|
| 1. | Submission of draft ATP by the tenderer as per AIR specification clause 1.12 in respect of all the offered equipments/items | Within **15 days** of issue of Acceptance of Tender |
| 2. | Submission of technical manuals as per AIR specification clause 1.5 in respect of all the offered equipments/items by the tenderer | Within **15 days** of issue of Acceptance of Tender |
| 3. | Submission of testing/measurement reports/OEM test certificates as per approved ATP along-with call for PDI by the tenderer | Within **20 days** from the date of approval of draft ATP |
| 4. | Call for Pre-dispatch Inspection (PDI) by the tenderer | At least **6 weeks** in advance from the proposed date of PDI |
| 5. | Delivery period as per AIR specification clause 1.8 | Within **SIX MONTHS** from the date of issue of Acceptance of Tender or **FIVE MONTHS** from the date of the Decision Letter from WPC (wherever is required) in respect of RF equipment, provided by AIR, whichever is later. |

## SECTION-II

**2.0 TRANSMITTER CONFIGURATION:**

20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration with automatic changeover control unit shall be supplied to each site with the following configurations: -

a) Each 20kW Digital Compatible FM Transmitter shall be supplied with two Exciter units i.e. one set of 20kW Digital Compatible FM Transmitter in (1+1) configuration shall have total four Exciter Units. The second Exciter unit will work as hot or active standby in automatic changeover mode (with manual override) which will also incorporate auto audio (Analog L/R, AES/EBU, RDS/DARC, SCA) changeover. The automatic changeover of Exciter should take place in case of failure of active Exciter.

b) 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter shall be configured to operate in (1+1) mode. The second 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter will work as hot or active standby in automatic change over mode (with manual override). The operation in (1+1) configuration is done by an Automatic Changeover Unit (ACU). The automatic changeover of Transmitter should take place when power of active Transmitter goes down by $\geq$ 3dB.

c) The audio shall be fed to both the Transmitter Units from single external audio source and therefore, proper arrangement of feeding the audio (Analog L/R, AES/EBU, RDS/DARC, SCA) to both the Transmitters through audio distribution unit shall be made.

d) 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration should have provision for automatic switching of either 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter to the Antenna & Dummy load. The automatic changeover of transmitter should take place when power of active transmitter goes down by $\geq$ 3dB.

e) 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter shall be frequency agile and capable of giving $\geq$20kW power continuously with minimum of 10% headroom.

f) The 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter should be compatible for HD Radio and DRM+ mode for future upgradation. However, **HD Radio/DRM+ Equipments shall not be the part of supply in respect of this tender.**

g) The 20kW Digital Compatible VHF FM Solid-State MOSFET technology based Broadcast transmitter should have the facility on the front panel of the transmitter for selection of either FM Mode **OR** Digital Mode **OR** (FM + Digital Mode) so that external HD Radio **OR** DRM+ Modulator is selected in place of FM Exciter.

h) The Power Amplifiers of the 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter should be able to switch into class AB linear mode for OFDM use without any requirement of modifications in the supplied transmitter equipment.

i) The transmitter should be complete in all respects. All India Radio will provide three phase, 4 wire power supply at a single point as per Section-I. All other transmitter's inbuilt subsystem shall derive supply through this source. No other voltage will be acceptable to AIR at the transmitter's input circuit breaker and failing which the offer is liable to be rejected. The performance of transmitter as per parameters in Section-

III should be ensured without degradation with the given power supply tolerances.

j) The transmitter should be capable for unmanned 24×7 operations.

k) Both transmitter equipment of (1+1) configuration shall be housed in separate rack having pleasing appearance. All metal works shall be protected against rust and corrosion. All materials used in transmitter shall be non-inflammable and fire retardant.

l) Equipment at all stages i.e. Exciter unit, IPA (as the case may be), PAs, combiner, harmonic filters etc. should be frequency agile and capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz **without** change of any component.

m) The transmitter shall be suitable for Mono and Stereo FM Radio Broadcast.

n) Transmitter should be of modular design for easy maintenance & part replacement. It should be possible to take out PA module without "switching off" the transmitter.

o) The transmitter construction shall ensure complete shielding of high power RF circuits to minimize radiation. The FM transmitter will have to work in a common transmitter hall having other high power Medium Wave transmitters, Short Wave transmitters, TV transmitters in VHF & UHF band as well as other FM transmitters. Therefore, the transmitter should be adequately protected from resultant E.M.C. (Electro Magnetic Compatibility) as per ETS-300447.

p) It should comply with IEC 60215 safety standards so as to eliminate hazards to personnel. Access to parts carrying dangerous voltages shall be through interlocked doors.

q) The transmitter will consist of solid state devices such as MOSFETS in IPA (if applicable)/PA stages. It must have auto ramp up circuit for power rise when transmitter is "Switched-On".
It should be possible to vary the transmitter power from a low value (minimum 1 kW) to full value from front control panel. Details to be provided by tenderer.

r) The Power Amplifiers and Exciter Unit of one transmitter should be interchangeable with second transmitter and vise-versa.

s) **The life of transmitter should be at least ten years and it must be certified by the OEM.**

**2.1 Exciter**:

2.1.1 The Exciter should have Direct Digital Synthesis. It should accept Analog Mono, Analog Stereo (left and right) / Encoded Stereo signals (MPX), RDS/DARC, SCA and AES/EBU inputs. It should be compatible for Mono and Stereo Broadcasting using pilot tone system.

2.1.2 It should have its own manually adjustable power control. The pre-emphasis should be selectable/switchable.

2.1.3 It should display various parameters like forward Power, reflected power, frequency deviation and input audio level on its front Panel. Status and faults should also be indicated.

2.1.4 It should be synthesized with easy channel selection of minimum 10 kHz spacing i.e. can be

operated on any of the frequency in VHF Band i.e. 88 MHz to 108 MHz. The Exciter should be **"Frequency agile"** i.e. not requiring any tuning over its entire specified operating frequency range.

**2.2 Intermediate Power Amplifier Modules (**If Intermediate Power Amplifiers are provided as per design of manufacturer): Total transmitter output power will be developed by an optimum combination of low power IPA modules and should be frequency agile and capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz **without tuning**.

The rated power output of the IPA unit and its maximum power output should be indicated. IPAs must be protected against "short" & "open" loads, "over-current", "high VSWR", "over-temperature", "over-drive" and "liquid flow" failure. The efficiency figures for each IPA are to be mentioned.

**2.3 Power Amplifier Modules**: Total transmitter output power will be developed by **four or more number of hot pluggable Power Amplifiers (PAs)** and should be capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz without tuning.

Each of the Power Amplifier (PA) should be inter changeable in any position. The rated power output of the PA unit and its maximum power output may be indicated. PAs must be protected against "short" & "open" loads, "over-current", "high VSWR", "over-temperature", "over-drive" etc. The efficiency figures for each PA are to be mentioned.

**2.4 Combiner Unit:** The final power combiner required to provide desired output power level by combining the power of various output power amplifier modules/stages shall be of such type so as to be capable to operate in entire VHF Band i.e. 88 MHz to 108 MHz without any tuning & change of components/settings.

The tenderer shall offer 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration in separate cabinet/rack i.e. separate rack for each transmitter. No other combination shall be acceptable.

The tenderer shall indicate the reduction in transmitter RF output power in case of failure of individual Power Amplifier units in the following format.

| S. No. | Number of PA Unit failure | Transmitter RF Power Output in kW |
|---|---|---|
| 1. | One No. | …… kW |
| 2. | Two Nos. | ……. kW |
| 3. | Three Nos. | …….. kW |
| 4. | Four Nos. | …….. kW |
| | | |
| N | N…Nos. | ……. kW |

Absorbers should be designed suitably so that they do not fail due to heat dissipation, in case of failure of power amplifier(s) resulting in unbalance power dissipation in absorbers.

**2.5 Final Output Harmonic Filter** for transmitter**:** The final Output/Harmonic Filter should be capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz without tuning & change of components/settings. The details along with schematic diagrams should be enclosed in the tender.

**2.6 Protection System**: Adequate protection system should be provided to safe guard the system from damage under fault conditions. The protection system should be fast acting to safe guard the system and components. Following are the typical requirements in this regard:

2.6.1 Protection against over loads, transients, severe fluctuation/variation in power supply, any other

malfunctioning etc. for transmitter as well as individual PAs etc.

2.6.2 Protection against over temperature on heat sinks.

2.6.3 Protection against air/liquid flow failure and less volume of cooling.

2.6.4 Protection against high VSWR including open and short conditions at output.

2.6.5 Immediate power fold back under severe/damaging fault conditions of VSWR and temperature. The power of transmitter should automatically come down to a suitable safe design limit, so that the transmitter and its subsystems do not get damaged due to load mismatch/ high temperature.

2.6.6 Transmitter should be protected against lightning by providing DC/RF discharge path and details of the same are to be given.

**2.7 Control and Interlocking:**

2.7.1 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 or manual controls on transmitter panel. Switching-in of the auxiliary units such as Dummy Load, Reject Loads, exhaust fan etc. shall be suitably interlocked. External units and accessories like Dummy Load, Change over Switches etc. should be wired in transmitter interlock.

2.7.2 Details of the control/monitoring/protection unit should be given.

2.7.3 It should be possible to switch off the entire transmitter in emergency by the operation of a single push button/manual command**.** This should be on front panel.

2.7.4 Stages of sequential operations of switching "ON" and "OFF" of the transmitter shall be indicated by use of suitably coded electronic display or through WEB GUI. In addition, all protections as indicated in clause 2.6 shall remain indicated until reset. The fault indication shall be supplemented with audible alarm.

**2.8 INSTRUMENTATION & INDICATIONS :**

All-important parameters required for monitoring and fault diagnosis should be displayed on either respective meters or on LCD display. Some of these are Forward & Reflected power of transmitter and individual PA units.

2.8.1 Transmitter status and fault conditions shall be indicated by colour coded display.

2.8.2 Transmitter shall have the facility to display Forward and reflected transmitter output power.

2.8.3 Suitable test points for operational check outside the module shall also be provided.

2.8.4 RF Outputs sample (Forward and Reverse) should be provided on connectors for performance measurement.

**2.9 COOLING SYSTEM:**

Full details of cooling system and subsystems shall be given. Details of cooling system and filters shall be given. Quantum of heat required to be handled by the cooling system is also to be indicated. Any special space requirement for installation of cooling system is also to be indicated.

**2.10 TRANSMITTER POWER SUPPLY:**

The transmitter shall be complete in all respects. The power supply requirement shall as per Section-I at a single point. All the power supply required for the transmitter and its associated equipments should be derived from the same point.

The AC and DC supply should have their protective devices. The rectifier and filter circuits should be able to take care of switching voltage surges on power lines. Adequate metering / indications like DC voltage and current to be provided. Power supply unit to be protected against "over temperature", "over-current" and "over-voltage", transients etc. The unbalance between the phases shall not exceed by 10% of the total

line/phase current during normal conditions of operation. The tenderer shall provide following technical details as per table given below, failing which the offer is liable to be rejected.

| Transmitter Power in kW | Phase Current ($I_R$) Amp. | Phase Current ($I_Y$) Amp. | Phase Current ($I_B$) Amp. | Neutral Current ($I_N$) Amp. |
|---|---|---|---|---|
| 2 | | | | |
| 4 | | | | |
| 6 | | | | |
| 8 | | | | |
| 10 | | | | |
| - | | | | |
| Up to 20 | | | | |

**2.11 AUTOMATIC CHANGEOVER CONTROL UNIT (ACU):**

(i) One Automatic Changeover Unit (ACU) for operating the transmitter in (1+1) configuration to facilitate automatic switch "ON" of the 2nd transmitter Unit in case of failure of RF output of 1st transmitter Unit shall be offered by the tenderer.

(ii) Any one of the 20kW Digital Compatible FM transmitter unit shall be selectable as master or slave automatically in active standby mode. When the RF power of the 1st transmitter goes down by 3 dB or more, it should be sensed as a failure to switch to second transmitter automatically. In case of failure of the complete system, there should be provision of three trials wherein against each trial, the time shall be adjustable up to 1 minute individually before final switch OFF.

(iii) Arrangement shall be made for bypassing the ACU in case of its failure so as to enable operating personnel to operate the transmitters in the manual mode.

(iv) Power Supply to the ACU shall be fed through the UPS.

(v) The changeover time between the two transmitters should be ≤ 30 seconds.

**2.12 REMOTE MONITORING AND CONTROL FACILITY:**

The transmitter shall have the facility for remote monitoring and control from distant location with web browser-based GUI and third party Network Management System/SNMP over TCP/IP using broadband connection with fixed I.P, with password protection using any PC/laptop or smart phone. Application should also be compatible with browsers like Chrome, Firefox etc.

The Remote monitoring and control facilities should be capable for controlling and monitoring various parameters of FM transmitter and automatic changeover unit from a distant location **as per details given in clause 3.10.**

Software and hardware required for remote monitoring and control of transmitter shall be part of the supply of the transmitter. The broadband connection with fixed I.P shall be provided by AIR.

MIB files will be provided by tenderer, if applicable.

**2.13 Single PA Operation:**

In case of multiple failures in Transmitter system, a mechanical arrangement with suitable RF Cable with connectors etc. is to be provided for single PA operation at its rated power in manual mode so that output of any PA can be fed directly to Antenna system with by-passing the RF Combiner.

## SECTION-III

## TECHNICAL SPECIFICATIONS OF TRANSMITTER

| S. No. | TECHNICAL PARAMETERS | TECHNICAL SPECIFICATIONS |
|---|---|---|
| **3.1** | **GENERAL** | |
| 3.1.1 | Frequency Range | 88 MHz to 108 MHz |
| 3.1.2 | Nominal Frequency Deviation | ±75 kHz (peak) |
| 3.1.3 | Maximum Frequency Deviation | ±100 kHz (peak) |
| 3.1.4 | Frequency Setting | Direct from front panel in 10 kHz steps |
| 3.1.5 | Class of Emission | 180KF8E |
| 3.1.6 | Stereo Transmissions | Pilot tone system |
| 3.1.7 | Pre-emphasis | 0, 50 µs (selectable). |
| **3.2** | **RF OUTPUT**: | |
| 3.2.1 | Rated Output Power | ≥ 20kW continuous with minimum headroom of 10%. |
| 3.2.2 | Output (Load) Impedance | 50 Ω unbalanced. |
| 3.2.3 | Permissible VSWR | 1.5: 1 with full power.<br>Power fold-back beyond 1.5: 1. Details of power fold back characteristics to be provided. |
| 3.2.4 | Harmonics and Spurious Suppression | Within limits as per Radio Regulations & ITU-R Rec<br>The actual values are to be indicated. |
| 3.2.5 | Overall Efficiency (AC to RF Out) for FM (Analog) Mode only | ≥ 70 %. |
| 3.2.6 | RF Output Connector | 3-1/8" with EIA flange |
| 3.2.7 | Max. Frequency Tolerance | As per ITU-R Rec. |
| 3.2.8 | Synchronous AM S/N Ratio referenced to 100% AM modulation at 400 Hz, 50 µs Pre-emphasis with FM modulation at ±75kHz deviation. | Better than 50 dB |
| 3.2.9 | Asynchronous AM S/N Ratio unweighted, referenced to 100% AM modulation at 400 Hz, 50 µs Pre-emphasis and without FM modulation. | Better than 55 dB |
| **3.3** | **INPUTS**: | |
| 3.3.1 | Modulating Input Signal | Exciter should accept Analog Mono, Analog Stereo (left and right)/Encoded Stereo Signals (MPX), AES/EBU, RDS/DARC and SCA inputs.<br>It should be capable for Mono and Stereo Broadcast using pilot tone system. |
| 3.3.2 | (i)Input Impedance (Analog) | 10 kΩ or greater (for Mono) |
| | | 10 kΩ or greater (for Stereo) |
| | (ii) Input Impedance (AES/EBU) | 110 Ω Nominal |
| 3.3.3 | Analog and AES/EBU input Level for ± 75kHz (peak) Deviation: | ANALOG AUDIO INPUT:<br>Input Level adjustable from -6 dBu to +6 dBu<br>AES/EBU AUDIO INPUT:<br>Input Level adjustable from -12dBFS to 0dBFS |

| | | |
|---|---|---|
| **3.4** | **POWER SUPPLY** | |
| 3.4.1 | Power | Three phase, 4 wire as per Section-I |
| **3.5** | **MONO OPERATION** | |
| 3.5.1 | FM S/N Ratio at ±75kHz Deviation (30 Hz to 15 kHz), rms, unweighted (22 Hz - 22 kHz) | Better than 70dB |
| 3.5.2 | Total Harmonic Distortion plus Noise (THD+N) (30 Hz to 15 kHz) | Better than 0.1% |
| 3.5.3 | Amplitude Response (30 Hz to 15 kHz) | Better than or equal to ± 0.2 dB |
| **3.6** | **STEREO OPERATION :** | |
| 3.6.1 | Stereo Separation at ±75kHz Deviation (30 Hz to 15 kHz) | Better than 50 dB |
| 3.6.2 | Linear Cross Talk referred to 100% modulation (30 Hz to 15 kHz) | Better than 50 dB |
| 3.6.3 | FM S/N Ratio at ±75kHz Deviation (L or R) (30 Hz to 15 kHz) rms, unweighted (22 Hz - 22 kHz) | Better than 70 dB |
| 3.6.4 | Total Harmonic Distortion Plus Noise (THD + N) (L or R) (30 Hz to 15 kHz) | Better than 0.1%. |
| 3.6.5 | Amplitude Response (L or R) (30 Hz to 15 kHz) | Better than or equal to ± 0.2 dB |
| 3.6.6 | Pilot Tone Stability | As per ITU-R Rec. |
| **3.7** | **WIDEBAND COMPOSITE OPERATION**: | |
| 3.7.1 | FM S/N Ratio at ±75 kHz Deviation, rms, unweighted (22 Hz - 22 kHz) | Better than 70 dB |
| 3.7.2 | Total Harmonic Distortion Plus Noise (THD + N) (30 Hz to 15 kHz) | Better than 0.1% |
| 3.7.3 | Amplitude Response (30 Hz to 100 kHz) | Better than or equal to ± 0.2 dB |
| **3.8** | **DIGITAL (DRM+ OR HD Radio) OPERATION:** | |
| 3.8.1 | MER (Modulation Error Ratio) at 25% of nominal rated analog RF Output Power of transmitter for pure digital mode in HD Radio/DRM+. | Better than or equal to 32dB @ 4QAM/16-QAM. |

**3.9. TESTING/CHECKING OF DIGITAL COMPATIBILITY OF THE OFFERED FM TRANSMITTER IN HD Radio** OR **DRM+ MODE DURING PDI:**

| S. No. | Parameter | Value Range | MER | Remarks |
|---|---|---|---|---|
| 1. | Analog Power | 20kW + Headroom (10%) | NA | Pure Analog Mode |
| 2. | Pure Digital Mode (DRM+) | ≥ 5kW (Digital) | | NA for HD Radio |
| 3. | Pure Digital Mode (HD Radio) Side bands only | ≥ 5kW (Digital) | | NA for DRM+ |
| 4. | Normal HD Radio Mode (-10dBc + Analog) | 2kW (Digital) + 10kW (Analog) | | NA for DRM+ |

## 3.10 TECHNICAL SPECIFICATIONS OF REMOTE MONITORING AND CONTROL FACILITY:

| S. No. | TECHNICAL PARAMETERS | TECHNICAL SPECIFICATIONS |
|---|---|---|
| 1. | Remote Monitoring and Control Facility<br>(Controllable Settings/Parameters) | 1. Transmitter: ON/OFF<br>2. Selection of Transmitter 1/2<br>3. Exciter: ON/OFF<br>3. Selection of Exciter1/2<br>4. RF Output Power Level Control<br>5. Audio input level |
| 2. | Remote Monitoring and Control Facility<br>(Monitorable Settings/Parameters) | 1. RF forward and reflected power of Transmitter<br>2. RF forward and reflected power of Exciter<br>3. RF forward and reflected power of each Power Amplifier<br>4. Power supply status i.e. Voltages, Currents etc.<br>5. Alarm Indications: Temperature, VSWR, ON AIR, Audio etc.<br>6. Any other parameters which the manufacturer considers essential for proper control /functioning of a remote-controlled FM transmitter. |
| 3. | Data Format | To be indicated by tenderer and compatible for above system. |
| 4. | Data Rate | To be indicated by tenderer and compatible for above data format. |
| 5. | Software and Hardware Items | Software and complete hardware items required for remote monitoring and control of transmitter shall be part of the supply of the transmitter. Details of offered items are to be given by the tenderer. |
| 6. | General Purpose PC | $11^{th}$ Generation or higher, Intel Core i7 processor or higher, minimum 19" FHD Screen, 16 GB RAM, Windows-10 or latest Operating System, Hard drive (Solid State Drive) $\geq$ 512GB, 2 x USB 3.2 ports, 2 x USB 2.0 ports, Headset Jack, HDMI (2.0), RJ-45, Keyboard, Mouse etc. |

## SECTION IV- TECHNICAL SPECIFICATION OF ASSICIATED EQUIPMENTS/ITEMS
## SECTION-IV (A) - TECHNICAL SPECIFICATIONS OF DUMMY LOAD AND THRU LINE RF POWER METER

**4.1 Dummy Load:** One number, 25 kW forced air cooled Dummy Load, 50 Ω are to be quoted for transmitter as per technical specifications given below.

| S. No. | TECHNICAL PARAMETERS | TECHNICAL SPECIFICATION |
|---|---|---|
| 4.1.1 | Power Rating | 25 kW continuous |
| 4.1.2 | Connector | 3-1/8" EIA Flange |
| 4.1.3 | Frequency Range | 88 to 108 MHz |
| 4.1.4 | VSWR | ≤ 1.10:1 |
| 4.1.5 | Impedance(Nominal) | 50 Ω |
| 4.1.6 | Load Cooling | Forced Air cooled |
| 4.1.7 | AC Power Supply | As per Section –I |
| 4.1.8 | Dimensions (Length x Width x Depth) | To be given by the tenderer. |
| 4.1.9 | Weight | To be given by the tenderer. |
| 4.1.10 | Environmental Conditions | As per Section –I |

**THRU LINE RF POWER METER**

| S. No. | TECHNICAL PARAMETERS | TECHNICAL SPECIFICATION |
|---|---|---|
| 4.1.11 | RF Power Meter (dual type) with simultaneous display and measurement of both FORWARD & REFLECTED power suitable for mounting in 19" rack with separate Transducers/Sensing elements for measuring forward (≤ 25 kW) & reflected (≤ 2.5 kW), elements sockets, line section and 1-5/8" EIA flanges including all accessories, cables complete (2 Nos.) as per specifications for connecting with the rigid line. | 1 Set |
| 4.1.12 | Power Rating: Forward Power | 25 kW continuous |
| 4.1.13 | Power Rating: Reflected Power | 2.5 kW |
| 4.1.14 | Frequency Range | 88 MHz to 108 MHz |
| 4.1.15 | VSWR | ≤ 1.1:1 |
| 4.1.16 | Impedance | 50 Ω |
| 4.1.17 | Accuracy | ± 5% or better |
| 4.1.18 | Directivity of Line Section | 30 dB or better |
| 4.1.19 | VSWR of Line Section | ≤ 1.05:1 |
| 4.1.20 | AC Power Supply | As per Section –I |
| 4.1.21 | Dimensions (Length × Width ×Depth) | To be given by the tenderer. |
| 4.1.22 | Weight | To be given by the tenderer. |
| 4.1.23 | Environmental Conditions | As per Section –I |

## SECTION-IV(B)-TECHNICAL SPECIFICATIONS OF MOTORISED RF CO-AXIAL CHANGEOVER SWITCH

**4.2 Motorized RF Co-axial Changeover switch:** Four ports, 3-1/8" Motorized RF coaxial Changeover switch fitted with 3-1/8" matching EIA flanges for connecting rigid line, including control panel, is to be quoted as per technical specifications given below. RF coaxial switch should work in manual mode also.

| S. No. | TECHNICAL PARAMETERS | TECHNICAL SPECIFICATIONS |
|---|---|---|
| 4.2.1 | No. of Ports | 4 |
| 4.2.2 | Input Ports, Output Ports, Termination/Dummy Load Port | 3-1/8" EIA male |
| 4.2.3 | Frequency Range | 88 MHz to 108 MHz |
| 4.2.4 | Impedance (Nominal) | 50 Ω |
| 4.2.5 | Power Supply | As per Section –I |
| 4.2.6 | Control Voltage | As per Section –I |
| 4.2.7 | Average Power Handling Capacity | ≥ 45.0 kW |
| 4.2.8 | Isolation | ≥ 60 dB |
| 4.2.9 | VSWR | ≤ 1.05 |
| 4.2.10 | Insertion loss | ≤ 0.05 dB |
| 4.2.11 | Mechanical life | ≥ 1, 00, 000 operations |
| 4.2.12 | Switching time | ≤ 2 sec. |
| 4.2.13 | Signaling and Interlock Contacts | The interlock contacts should be coupled with RF contacts for interrupting RF power before and during switching. They should open before the RF contacts separate and closes after the RF contacts are in their new position. The auxiliary contacts should be suitably rated. Status of RF Switch contact position should be displayed only when it is in proper contact. |
| 4.2.14 | Dimensions (Length × Width × Depth) | To be given by the tenderer. |
| 4.2.15 | Weight | To be given by the tenderer. |
| 4.2.16 | Control panel | Suitable for above Motorized RF co-axial Changeover switch. |
| 4.2.17 | Environmental Conditions | As per Section-I |

## SECTION –IV (C) -TECHNICAL SPECIFICATION OF RF COAXIAL COPPER RIGID LINES & ASSOCIATED ACCESSORIES

**4.3** Transmitter power will be fed to the Antenna System by an internal 3-1/8" RF coaxial copper rigid line and then an external air dielectric RF coaxial cable of suitable size.
Following are the Technical Specifications of RF coaxial copper rigid lines & associated accessories: All RF coaxial copper rigid lines with associated accessories are to be offered as per details given in SECTION-V(A). RF coaxial copper rigid lines and associated accessories should be of standard make.

| S. No. | TECHNICAL PARAMETERS | TECHNICAL SPECIFICATION | |
|---|---|---|---|
| 4.3.1 | Size | 1-5/8" | 3-1/8" |
| 4.3.2 | Attenuation @100 MHz at 20°C | $\leq$ 0.65 dB/100M | $\leq$ 0.35 dB/100M |
| 4.3.3 | Average power handling capacity at ambient temperature 40°C | $\geq$ 12 kW | $\geq$ 45 kW |
| 4.3.4 | Frequency Range | 88 MHz-108 MHz | 88 MHz-108 MHz |
| 4.3.5 | Impedance | 50 Ω | 50 Ω |
| 4.3.6 | Material for Outer & Inner Conductor of Rigid lines | High conductivity copper conforming to 95% IACS/99% purity | High conductivity copper conforming to 95% IACS/99% purity |
| 4.3.7 | Material for Outer Conductor for Elbows & Adapters | Copper/ Copper alloy | Copper/Copper alloy |
| 4.3.8 | Material for Inner Conductor for Elbows, Adapters and for all the entire support inner bullets | Silver-plated brass/ Silver-plated Copper | Silver-plated brass/ Silver-plated Copper |
| 4.3.9 | Material for all the support insulators | High quality Virgin Teflon (PTFE) | High quality Virgin Teflon(PTFE) |

**SECTION V (A): SCHEDULE OF REQUIREMENTS / MATERIALS (UN PRICED) FOR ONE SET OF 20kW FM TRANSMITTER & ASSOCIATED EQUIPMENTS/ITEMS) {The tenderer must quote all items}**

| S. No. | Description | Make | Model | Qty. |
|---|---|---|---|---|
| 1. | (i) Supply of 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration including 4 Nos. of Exciter units in total, against both the transmitters including technical manuals as per AIR Specifications. | | | 1 Set Complete |
| | (ii) Supply of Automatic changeover unit for 20kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration complete with all accessories as per specification. | | | 1 Set Complete |
| | (iii) Supply of Software & Hardware items required for Remote Monitoring & Control facilities as per AIR specifications | | | 1 Set Complete |
| 2. | Supply of General Purpose PC for Remote Monitoring & Control facilities complete as per AIR specifications (COTS item) | | | 1 Set Complete |
| 3. | Supply of complete installation material as given below such as RF Coaxial rigid lines, elbows, couplings & matching reducers, wherever necessary to complete the installation for feeding to the Antenna & Dummy Load as per AIR specifications. [Rates per meter/number shall also be quoted in addition to rates of quantity given in column (5)] | | | |
| 3.1 | 3-1/8″ RF coaxial copper Rigid (complete with outer, inner & insulators) | | | 24 M |
| 3.2 | 3-1/8″ Un-flanged 90º Elbow with equal leg (complete with outer, inner & insulators) | | | 12 Nos. |
| 3.3 | 3-1/8″ Clamp type Coupling (complete with outer, inner & insulators) | | | 16 Nos. |
| 3.4 | 3-1/8″ to N Test reducer /adapter | | | 2 Nos. |
| 3.5 | 3-1/8″ Field Flange (Clamp type) | | | 7 Nos. |
| 3.6 | Hanger for 3-1/8″ RF coaxial Rigid Line | | | 16 Nos. |
| 3.7 | 3-1/8" to 1-5/8" reducer (un-flanged) | | | 2 Nos. |
| 3.8 | 1-5/8" to N Test Reducer | | | 2 Nos. |
| 4. | Supply of 25 kW Forced air cooled Dummy Load, 50 Ω as per AIR specifications. | | | 1 Set complete |
| 5. | RF Power Meter (dual type) with simultaneous display and measurement of both FORWARD & REFLECTED power suitable for mounting in 19" rack with separate Transducers/Sensing elements for measuring forward (≤ 25 kW) & reflected (≤ 2.5 kW), elements sockets, line section and 1-5/8" EIA flanges including all accessories, cables complete (2 Nos.) as per specifications for connecting with the rigid line. | | | 1 Set Complete |
| 6. | Supply of Four ports, 3-1/8" Motorized RF coaxial changeover switch with 3-1/8" matching EIA flanges for connecting rigid line including control panel as per AIR specifications. | | | 1 Set Complete |
| 7. | Supply of mechanical arrangement for single PA operation as per AIR specifications. | | | 1 Set Complete |
| 8. | Supply of any other items/accessories required for the completeness of the system. Items wise details (including part number, if any) are to be given by the tenderer). **State NA, if not applicable.** | | | 1 Lot |
| 9. | Inspection charges as per AIR specification. | | | 1 Lot |

**SECTION V (B): SCHEDULE OF REQUIREMENTS / MATERIALS (UN PRICED) FOR SUPPLY OF ONE SET OF 20kW FM TRANSMITTER & ASSOCIATED EQUIPMENTS/ITEMS) SPARE (OPTIONAL) {The tenderer must quote all items}**

| S NO. | Description | Make | Model | Qty. |
|---|---|---|---|---|
| 1. | Supply of 20kW Digital Compatible (HD Radio & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter (Single Unit) with two Exciters as per AIR Specification. | | | 1 Set Complete |
| 2. | Supply of Exciter Unit | | | 1 Set Complete |
| 3. | Supply of Power Amplifier Module | | | 1 Set Complete |
| 4. | Supply of Power Supply Unit for Exciter Unit | | | 1 Set Complete |
| 5. | Supply of Power Supply Unit for Power Amplifier Unit | | | 1 Set Complete |
| 6. | Supply of RF Power Combiner Unit (20kW) | | | 1 Set Complete |
| 7. | Supply of Automatic Changeover Unit | | | 1 Set Complete |
| 8. | Supply of LPF/BPF/Harmonic filters (if used in the Power Amplifier output Stage) | | | 1 Set Complete |
| 9. | List of recommended PCB spares, if any (Details of equipments/items may be given) | | | 1 Set Complete |
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**Annexure-I**

**INSPECTION OF TRANSMITETRS**

The inspection for acceptance of the transmitter equipment on dummy load will be carried out at OEM's Works Place by Engineers of All India Radio (AIR) in accordance with Acceptance Test Procedure/Protocol (ATP). All facilities like complete set of measuring instruments, power supply, manual assistance etc. will be provided by the tenderer/OEM. Complete details and specifications of the transmitter will be checked and all parameter values will be measured.

**All the testing/measurements including Operational & functional checking of the transmitter during PDI will be carried out at 110% of the rated output power of the offered transmitter.**

The tenderer is also required to demonstrate the digital compatibility of the offered VHF FM transmitter in HD Radio **OR** DRM+ mode during PDI. All measurements applicable for HD Radio/DRM+ mode shall also check as per AIR specifications. All necessary equipments required for checking the compatibility of the offered FM transmitter in HD Radio or DRM+ mode during inspection will be arranged by the tenderer.

All the spares ordered as per AT will be tested in actual circuit during inspection by Engineers of AIR.

Testing/measurements including operational & functional checking of all the transmitters shall be carried out at three different frequencies **including** operating frequency of the transmitter in the VHF Band i.e. 88 MHz to 108 MHz as per approved ATP.

Exhaustive checking and measurements will be carried out so as to completely check the compliance of the transmitter and its sub systems with the requirements as projected in the specifications.

Testing/measurements including Operational & functional checking of the transmitter will be carried out on three phase, 4-wire, 400 Volt (rms) ± 10%, 50 Hz ± 4% power supply available at the transmitter's input circuit breaker without any outside transformer unit etc. No other voltage will be acceptable to AIR at the transmitter's input circuit breaker, failing which the transmitter equipment is liable to be rejected. The technical facilities/equipment for varying within ± 10% of 400Volts (rms), three phase, 4-wire, should be available for Testing/measurements including Operational & functional checking of the transmitter during the inspection. The performance of transmitter as per parameters in Section-III shall be guaranteed without degradation with the given power supply tolerances.

It is mandatory that testing/measurements including operational & functional checking of all the transmitters as per approved ATP at three different frequencies including operating frequency of the transmitter in the VHF Band i.e. 88 MHz to 108 MHz without change of components/ settings/tuning are carried out well in advance. These measurements as per approved ATP must be submitted to All India Radio along with the call for inspection of transmitters for analyzing etc. These measurement details etc. must also be available at the time of inspection.

Following information should also form part of above data which will also be checked for each transmitter during inspection by AIR Inspecting Engineers**:-**

1. Origin of Country, Make, Type, Model & name of all units of transmitter, associated equipments/items and spares.
2. Dimensions of transmitter rack, sub-units, other items & accessories.
3. Working/operation of all sub-units and accessories.
4. System configuration check and completeness of transmitter.
5. Checking meter readings and calibration.
6. Checking of control and protection system of transmitter.
7. Checking of all power levels, meters, LEDs etc.
8. Checking of RF voltages on test points.
9. Inter-changeability of PAs, sub-modules etc.
10. Exciter operation, checking and measurements.
11. Working of Exciter in all mode including modulating inputs as per specifications.
12. Measurement of levels in the whole AF and RF chain.
13. Checking of all spares, PCB's, modules for the respective transmitter, other items & accessories.

**ANNEXURE-II**

TRANSMITTER TECHNICAL DATA TO BE SUBMITTED BY THE TENDERER

| **S. No.** | **Description** | **Details to be submitted by the tenderer** | | |
|---|---|---|---|---|
| 1.0 | Transmitter dimensions: | Width: ……(mm) | Height: ……(mm) | Depth: ……(mm) |
| 2.0 | Transmitter weight: | …….. kg | | |
| 3.0 | Transmitter Heat dissipation at 20kW RF output: | …….. kW<br>…….. BTU/ Hr | | |
| 4.0 | Transmitter Air –conditioning requirement: | …….. TR | | |
| 5.0 | Number of racks: | …… Number | | |
| 6.0 | Size of racks:<br>Transmitter rack dimensions: | Width: ……(mm) | Height: ……(mm) | Depth: ……(mm) |
| 7.0 | Blower/Fan of cooling system (Total No. of Blowers/fans) | ……. Number | | |
| 8.0 | Power consumption at 20kW RF output: | …….. kW | | |
| **9.0** | **Typical Power supply line voltages (phase to phase voltages)** | | | |
| 9.1 | Voltage between Red phase & Yellow phase: | …… Volt | | |
| 9.2 | Voltage between Yellow phase & Blue phase: | …… Volt | | |
| 9.3 | Voltage between Blue phase & Red phase: | …… Volt | | |
| **10.0** | **Typical Power supply phase voltages (phase to neutral voltages)** | | | |
| 10.1 | Voltage between Red phase & Neutral: | …… Volt | | |
| 10.2 | Voltage between Yellow phase & Neutral: | …… Volt | | |
| 10.3 | Voltage between Blue phase & Neutral: | …… Volt | | |
| **11.0** | **Typical Power supply line current/phase current** | | | |
| 11.1 | Line current/Phase current (Red phase): | …… Amp. | | |
| 11.2 | Line current/Phase current (Yellow phase): | …… Amp. | | |
| 11.3 | Line current/Phase current (Blue phase): | …… Amp. | | |
| 11.4 | Neutral current: | …… Amp. | | |
| **12.0** | **Power factor:** | **……** | | |

**ANNEXURE-III**

**PERFORMA FOR INFORMATION ABOUT LOCAL OFFICE /AUTHORIZED REPRESENTATIVE/ DEALER IN INDIA FOR AFTER SALES SUPPORT**

| | | |
|---|---|---|
| 1. | Address of local office/authorized representative/ dealer | |
| | Telephone (Landline) No. | |
| | Mobile No. | |
| | E-mail Address | |
| 2. | Address for communication (if different) | |
| 3. | Legal Status ( local office/authorized representative/dealer ) | |
| 4. | Name, contact number (Mobile number) & e-mail address of official representative of the local office/authorized representative/dealer | |
| 5. | Brief details of Technical facilities available for after sales support:<br><br>The details of technical facilities available with local office/authorized representative/dealer for after sales support such as test bench, necessary test & measuring equipment and photographs thereof, must be provided in the technical bid. | |
| 6. | Main line of business, specialization and number of years of operation | |
| 7. | Total number of permanent technical employees including their designation and qualification | |
| 8. | Details of Agreement/MoU for after sales support with OEM (Copy must be provided with the offer) | Date of Agreement:<br><br>Executed at :<br><br>Executed by : |

| | |
|---|---|
| **(Authorized Signatory of local office/authorized representative/dealer)**<br><br>Name :<br><br>Signature : | **(Authorized Signatory of transmitter OEM)**<br><br>Name :<br><br>Signature : |
| Place and Date: | Place and Date: |