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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No. SPECS-10 kW FM TX/9/4/2014-D (TD/FM) Dated 20.05.2019

Subject: Specification for supply of 10 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter **(Liquid Cooled)** in (1+1) configuration and associated equipments/items

Kindly find enclosed herewith the draft technical specification [**AIR Specification No. 10 kW FM TX/36/November/2018 -D (TD/FM)-Rev.II]** for Supply of 10 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter **(Liquid Cooled)** in (1+1) configuration and associated equipments/items, to get feedback from Original Equipment Manufacturers (OEMs) of the product/prospective bidders.

Please submit your feedback via e-mail on or before 03.06.2019 at 17.00. Hrs. at the following e-mail addresses.

satyendra@prasarbharati.gov.in
rnahar@prasarbharati.gov.in
manzoor@prasarbharati.gov.in

Encl: As above.

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Asstt. Director (Engg.)
for Director General
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PRASAR BHARATI
(*India's Public service Broadcaster***)**
DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)-
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SPECIFICATIONS FOR SUPPLY OF 10 kW DIGITAL COMPATIBLE VHF FM SOLID-STATE MOSFET TECHNOLOGY BASED BROADCAST TRANSMITTER (LIQUID COOLED) IN (1+1) CONFIGURATION AND ASSOCIATED EQUIPMENTS/ITEMS

INTRODUCTION: This specification is for supply of 10 kW Digital Compatible (**Transmitter should be able to switch into class AB linear mode for OFDM use**) VHF FM solid-state MOSFET technology based broadcast transmitter **(Liquid Cooled)** in (1+1) configuration and associated equipments/items.

SUMMARY

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A. ESSENTIAL REQUIREMENT FOR TENDERERS:

1. (i) The tenderer should submit Schedule of Requirements/Materials of Supply **without *price* *in the same format as given in Section-IV (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.

2. Each statement of this specifications has to be complied with & supported by printed technical literature, technical data sheets, schematic drawings and technical manuals from the manufacturer of the equipment by the tenderer, to assess the full merit of the offer without which tender will be considered incomplete and is liable to be rejected.

3. The tenderer should submit the tender offer to AIR 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 compliance statement, to assess the full merit of the offer, failing which the 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 tenderers				
B. Essential eligibility criteria for tenderer				
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 offer for spares **(OPTIONAL)** in commercial bid.

5. The complete technical specifications (Section wise & Clause wise) compliance statement along with Schedule of Requirements/Materials (un-priced) must be signed & stamped on each page by the respective Original Equipment Manufacturer (OEM) in the tender document including the clarifications, if any, asked by AIR, 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 each page of the complete Technical specifications compliance statement (Section wise & Clause wise) including the clarifications, if any, asked by AIR, 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 on each page. 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 on each page, failing which the tender shall be considered incomplete and is liable to be rejected without any notice/back reference. Guarantee shall be as per the format given in clause 1.8 of Section-I. Guarantee for the commercially available off-the-shelf (**COTS**) products shall be given by tenderer/OEM of the transmitter.

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. Public Procurement (Preference to Make in India) Order No. P-45021/2/2017-B.E-II dated 15.06.2017 of Government of India, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion shall be applicable.

10. Any change in the AIR technical specifications format or language or in parameters or of any other nature including the deletion 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.

11. ***Optional items will not be considered for ranking purpose.***

B. ESSENTIAL ELIGIBILITY CRITERIA FOR TENDERER:

(a) The tenderer should either be the OEM of VHF FM transmitter or their authorized representative/dealer.

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

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

Order No. with date, reference	Transmitter Type, Model and Transmitter Power Output	Qty.	Name of the broadcaster with full postal address including e-mail address to whom transmitter was supplied, for getting feedback on transmitter performance.	Remarks
(1)	(2)	(3)	(4)	(5)

(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 order for supply and completion certificates/delivery challans/invoice of at least 10 Nos., out of the 20 Nos. of such (**liquid cooled) VHF FM transmitters** of not less than 10 kW power output submitted by the tenderer in above format, are also to be enclosed by the tenderer.

(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 5 kW/10 kW **OR** must be in the business of sales and supply of VHF FM transmitters/TV transmitters/AM Transmitters of power not less than 5 kW/10 kW for last three years or more. Documentary evidence to support this must be provided.

(d) The OEM of the offered VHF FM transmitter must have his local office/authorized representative/dealer in India only for after sales support. **A certificate** in this regard duly signed by the OEM, on their letterhead **as per Annexure-III** including copy of Agreement/MoU in this regard between OEMs and their local representative/dealer **and signed by both** must be submitted with the offer.

(e) 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 at site. 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 that will arrange repairs locally. The cost of transportation, repairs etc. shall be borne by the tenderer during the guarantee period.

(f) 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 representatives/dealers in India.

(g) The OEM should have complete setup for maintenance/repair of the transmitter in India, either of its own or through authorized service provider.

(h) The details of technical facilities in the local after sales support office, such as test bench, necessary test & measuring equipment and photographs thereof, must be provided in the technical bid.

(i) AIR representatives may visit the works of local 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 without any notice/back reference.

SECTION-I GENERAL

Brief Description:

1.0 10 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter (Liquid Cooled) in (1+1) configuration shall be capable of round the clock operation.
The transmitter shall be complete in itself, integrated in standard rack and shall be supplied with associated equipments/items as per Section-V (A&B). The transmitter shall be field proven for satisfactory operation.

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

1.1.1 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).
1.1.2 Power supply connection for the transmitting equipment at a single point.
1.1.3 Furniture & fittings not forming a part of the transmitter equipment.

1.2 Tender documents (instructions to bidders) shall be referred for general terms 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 INFORMATION TO BE SUPPLIED WITH THE TENDER:

1.4.1 The complete technical specifications (Section wise & Clause wise) compliance statement alongwith Schedule of Requirements/Materials (un-priced) duly signed & stamped on each page by the 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 10 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter (Liquid Cooled) 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 is liable for rejection.

1.4.3. Detailed Schedule of Requirements/Materials (un-priced) for the supply of 10 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter (Liquid Cooled) 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 is 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 transmitter shall be installed by AIR engineers as per the instructions given in the Installation Manual. The Technical Manual {for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}must include at least the details given below:

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

(i) A suggestive floor equipment layout plan drawing with dimensions in metres for installation of the VHF FM transmitter system in a transmitter hall with all associated equipment.

(ii) Diagrams showing the isometric view of VHF FM transmitter and associated equipment with dimensions in metres are to be provided.

(iii) All installation drawings with dimensions in respect of supplied equipment are to be provided.

(iv) All mechanical assembly drawings of the VHF FM transmitter system with dimensions are to be provided.

(v) All the views, i.e. front, rear, top and side (open) of the VHF FM transmitter with dimensions are to be provided.

(vi) The details of unpacking are to be provided.

(vii) A detailed write up in English only regarding installation of VHF FM transmitter system along with its associated equipments/items should be provided.

(viii) The procedure of alignment and adjustment of various assemblies & sub-assemblies of VHF FM transmitter such as Exciter, PA, Control Circuit, output stage etc. should be described in detail with practical examples.

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

(x) 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 should be provided.

(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) General description and structural overview of the transmitter racks indicating the position of different modules, units, power distribution etc., front, rear, top & side (open) views with dimensions.

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

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

(v) 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 transmitter should be provided with details of test points.

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

(vii) 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.**

(viii) 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.

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

(x) Details and schematic drawings of remote control & operation by telemetry system using Simple Network Management Protocol(SNMP) over TCP/IP network along with screen shots of the interface displays. The remotely monitorable and controllable parameters of the transmitter should be clearly indicated.

(xi) General description of transmitter control system and schematic drawing(s) for control signal distribution should be provided.

(xii) A detailed description of working of circuits with all relevant circuit diagrams for the control circuit of the transmitter should be provided.

(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) 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 exciter unit should

be provided with details of test points.

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

(xvi) 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 Power Amplifier should be provided with details of test points.

(xvii) Description of VHF FM transmitter and the details of No. of PAs, combiners etc. used.

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

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

(xx) Description of VSWR/temperature foldback alongwith range of foldback. The explanation of foldback with the help of circuit diagram must also be provided.

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

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

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

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

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

(xxvi) All details of putting "ON" and "OFF" the transmitter, with the sequence of operation of the transmitter.

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

(xxviii) Procedure for operating the transmitter below the rated power of 10 kW.

(xxix) The detailed procedure and possibilities of by-passing control circuit should be described with diagrams.

(xxx) The description of manual operation of control system and cooling system.

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

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

(xxxiii) The various test and measuring equipment required and essential for the routine maintenance and calibration along with the procedure for taking such measurement should be mentioned.

(xxxiv) Various test fixtures and accessories required for the maintenance/repair of the VHF FM transmitter should be described clearly.

(xxxv) The detailed procedure for trouble shooting of the VHF FM transmitter preferably up to component level should be described.

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

(xxxvii) The maintenance schedule for the transmitter should also be described.

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

(Y.P. Singh, AE) (Vijendra Panwar, AE) (Manzoor Ali, ADE) (Rajendra Nahar, DDE) (Aditya Chaturvedi, DDG-E)

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
(ii) Dummy Load-15 kW
(iii) Thru line power meter
(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.*

1.5 INFORMATION TO BE SUPPLIED BY THE TENDERER WITHIN ONE MONTH 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 10 kW (1+1) Digital Compatible VHF FM transmitter (Liquid Cooled) 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 Control & Monitoring Equipment etc. along with one soft copy on CD must be supplied to "The DDG (E-FM), P & D Unit, DG: AIR, New Delhi-110001".

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 INFORMATION TO BE SUPPLIED ALONG WITH EQUIPMENT:

1.7.1 Two sets of **colour printed** & duly bound copies of Technical Manuals as mentioned in clause 1.5 as above along with a copy of filled ATP (duly signed by AIR Inspectors & OEM), OEM test certificates of associated equipments/items alongwith soft copies are to be supplied to each consignee.

1.7.2 The Technical Manuals as mentioned in clause 1.5 alongwith soft copies are required to be sent (irrespective of number of transmitters ordered) to the officers/offices as per SECTION-V(A).

1.8 DELIVERY PERIOD OF EQUIPMENT:

1. For Indian Bidders:

Supply will have to be completed within Five (5) months from the date of Acceptance of Tender or Five (5) months from the date of the Decision Letter from WPC(wherever is required) in respect of RF equipment, provided by AIR, whichever is later.

2. For Foreign Bidders:
Supply will have to be completed within Five (5) months from the date of Opening of Letter of Credit (LC).

1.9 GUARANTEE:

The tenderer shall submit with his offer an undertaking to accept the following guarantees:
{This Guarantee clause is applicable to all the 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 7 days (from the date of first intimation to OEM/tenderer) at tenderer's expense any component which becomes defective under normal operating conditions for 60 months from the date of supply. If the tenderer failed to rectify the fault within the stipulated period of 7 days, the guarantee period would be extended corresponding to the outage period.
(iii) A guarantee to supply all components for a period of ten 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.

1.10 INSPECTION:

1.10.1 Detailed inspection of each transmitter equipment on dummy load (being supplied alongwith the transmitter) will be carried out at Manufacturer's Works by **two Engineers** of All India Radio as per details given in **Annexure-I.**

1.10.2 Call for Pre-dispatch Inspection(PDI) of all the transmitter at OEM's Works is to be given by the tenderer to All India Radio at least **8 weeks** in advance. Inspection period will be two days for first transmitter, one day each for subsequent numbers of transmitters & one day to test the compatibility of the transmitter for HD **OR** DRM+ mode. Testing/measurements reports as per approved ATP must be submitted to All India Radio along with the call for inspection of transmitters for analyzing etc.

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

1.10.4 The complete Acceptance Test Procedure/Protocol (ATP) will be prepared by the OEM of the transmitter and submitted to DDG (E-FM), P&D Unit, DG: AIR for approval within one month 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 at factory. 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.

1.10.5 Inspection of all other associated equipment/items i.e. Dummy Load, Motorized RF coaxial changeover switch, RF coaxial copper rigid line etc. as per details given in **Annexure-I.**

1.11 MAINTENANCE SUPPORT AND SPARES:

(a) The minimum recommended essential spares (like modules of PA, Power Supply Modules or any other critical spares suggested by the OEM), required to maintain the continued service of the transmitter in a reliable manner, shall be quoted separately by the tenderer.

(b) The minimum recommended essential spares may be based on predicted rate of failure.

(c) The OEM shall also give a certificate attached with the offer to extend repair/maintenance support and supply all spares during the lifetime of the transmitter. The life of transmitter should be more than ten years and it must be certified by the OEM.

(d) 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 likely to be rejected.

1.12 LOCAL REPRESENTATIVE/DEALER:

(a) The OEM of the offered VHF FM transmitter must have his local office/authorized representative/dealer in India for after sales support. **A certificate** in this regard duly signed by the OEM, on their letterhead **as per Annexure-III** including copy of Agreement/MoU in this regard between OEMs and their local representative/dealer **and signed by both** must be submitted with the offer.

(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 at site. 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 that 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 representatives/dealers in India.

(d) The OEM should have complete setup for maintenance/repair of the transmitter in India, either of its own or through authorized service provider.

(e) The details of technical facilities in the local after sales support office, such as test bench, necessary test & measuring equipment and photographs thereof, must be provided in the technical bid.

(f) AIR representatives may visit the works of local 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 without any notice/back reference.

1.13 TRAINING AT SITE:

a. OEM(s) shall train a team of AIR Engineers for 5 working days at **OEM's Works** to become acquainted with all particulars as well as installation, operation, maintenance, Servicing, 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 within One Month after approval of ATP.

1.14 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 DDG (E-FM), P & D Unit, DG: AIR, New Delhi.

1.15 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 3000 meters AMSL

1.16 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

1.17 POWER SUPPLY FOR SINGLE PHASE EQUIPMENTS:

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

SECTION-II
TECHNICAL DESCRIPTION OF TRANSMITTER

2.0 TRANSMITTER CONFIGURATION:

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

a) (i) 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration with automatic changeover unit shall be supplied at **each site**. 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) shall be configured to operate in (1+1) mode. The second 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) will work as hot or active standby in automatic change over mode (with manual override) which will also incorporate auto audio changeover. 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.

(ii) **Each site** will be supplied in total, two (2) number of Exciter units that will work in both the transmitters by physically shifting from one transmitter rack to other transmitter rack. When both Exciters units are taken in circuit of one transmitter, 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 when power of active Exciter goes down by $\geq$ 3dB.

(iii) In normal condition, AIR will use one Exciter in each transmitter rack. Therefore, both the transmitter shall have the provision to work with single Exciter as well with two Exciters.

b) 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration should have provision for automatic switching of either 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) to the Antenna & Dummy load. The automatic changeover of transmitter should take place when power of active transmitter goes down by $\geq$ 3dB.

c) 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) without tuning (frequency agile) shall be capable of giving $\geq$10 kW power continuously. It should consist of a number of low power hot pluggable modular power amplifiers. It should consist of not less than two numbers of hot pluggable Power Amplifiers (PAs).

d) The 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) should be compatible for HD Radio **OR** DRM+ mode. **HD/DRM+ Equipments are not the part of Supply with this tender.** However, all necessary equipments required for checking the compatibility of the offered VHF FM transmitter in HD **OR** DRM+ mode during inspection at OEMs works will be arranged by the tenderer.

e) The 10 kW Digital Compatible VHF FM Solid-State MOSFET technology based Broadcast transmitter (Liquid Cooled) 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.

f) The Power Amplifiers of the 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) **should be able to switch into class AB linear mode for OFDM** use without any requirement of modifications in the supplied transmitter equipment.

g) The transmitter will 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.**

h) The transmitter should be suitable for unattended 24×7 operations.

i) The transmitter equipment shall be housed in a 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.

j) All stages i.e. Exciter unit, IPA (as the case may be), PAs, combiner, harmonic filters etc. should be capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz **without** change of components/settings/tuning.

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

l) 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.

m) 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.

n) 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.

o) 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.

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.

2.1.1.1 All the input modules mentioned in 2.1.1 must be included in the offer of Exciter unit i.e. on board or separate input modules to be used in one or same slot (Stereo input/output AES/EBU module & Analogue Stereo input/output modules).

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 and reflected power, frequency deviation, input audio level on its panel meters or LCD display. Status and faults should also be indicated. Full details of parameters being measured/displayed to be provided.

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 capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz **without tuning**.

Redundancy for IPA is required. The redundant IPA unit will work as hot **or active standby unit** in automatic change over mode. This change over mode should also be integrated with Exciter change over as well as audio input change over.

Each of the IPA will be inter-changeable in any position. 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 "air/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 not less than two 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**.
The design of the Power Amplifier should be such that there should not be a single point failure which may result in total loss of RF power output from the Power Amplifier.

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" and "liquid flow" failure. 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 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration in separate cabinet/rack. 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
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 pump 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. **Details of fold back are to be provided.**
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. 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. Number of meters/transducers with details should be enclosed with tender.

2.8.1 Transmitter status and fault conditions shall be indicated by colour coded display on a mimic diagram. Number of LEDs or display for **"status indication"** and **"fault indication"** to be provided.

2.8.2 Transmitter shall have the facility to display Peak and average transmitter power output.

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

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

2.9 **LIQUID COOLING SYSTEM:**

Full details of liquid cooling system and subsystems shall be given.

(a) The transmitter must have closed circuit liquid cooling system. Air cooled transmitter system is not acceptable. The cooling system alongwith required pipes and hoses must be provided by the OEM of the transmitter only.

(b) Normal and standby transmitter in (1+1) configuration shall have separate and independent cooling system and heat exchangers. Each transmitter cooling system should have two nos. of pumps & two nos. of fans in heat exchangers for adequate redundancy of pumps and fans with automatic changeover to make it fully reliable. Manual changeover should also be possible.

(c) The detail of type of coolant and quantity required against each transmitter must be provided by the OEM of the transmitter.

(d) Full required quantity of the spare coolant is also to be supplied with the system in addition to the filled up

quantity for the transmitter.

(e) A proper and professional coolant filling arrangement shall also to be supplied with the cooling system.

(f) Particle filter, monitoring of temperature at inlet and outlet, flow sensors and pressure sensor should be provided.

(g) One set of all the essential tools required for installation, maintenance & servicing of cooling system must be supplied with each transmitter.

(h) Tubes and Hoses on amplifiers etc. shall be of self-locking type so that no liquid leaks during changeover/replacement/repairing.

(i) Outside temperatures may vary from -10^{o} C to $+50^{o}$ C. Heat exchanger and liquid coolant used must be compliant with these temperature variations.

(j) The capacity of the heat exchanger and the pumps etc. should be such that it is suitable for the Transmitter.

(k) Full detailed description of the liquid cooling system is to be provided with the offer. A typical diagram, showing details of liquid cooling system and heat balancing of transmitter system bringing out all special requirements, should be attached with the offer.

(l) A typical layout showing the maximum permissible distance between the transmitter and the cooling system (Pump assembly and heat exchanger assembly) must also be provided with the offer. The necessary length of the pipes as per the maximum permissible distance must be supplied.

2.10 **TRANSMITTER POWER SUPPLY:**

The transmitter shall be complete in all respects. AIR shall provide three phase, 4 wire power supply 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. Suitable Ferrite-Core of reputed make (Fair-Rite etc.) should be provided at the power supply input terminal for protection against RFI/EMI. 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. The tenderer shall provide following technical details as per table, failing which tender is likely 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.
1				
2				
4				
6				
8				
10				

2.11 SPARES (OPTIONAL): The tenderer shall quote for one set of spares based on failure pattern as per section-V(B). 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.

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2.12 AUTOMATIC CHANGEOVER 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 10 kW Digital Compatible FM transmitter (Liquid Cooled) 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, three trials at interval adjustable up to 10 minutes shall be done before final switch OFF.

(iii) The audio shall be fed to both the Transmitter Units from external sources and therefore, proper arrangement of feeding the audio in Changeover Unit and permanent feeding to both the Transmitters shall be made. In case of audio failure, an indication shall be displayed.

(iv) The complete switching sequence of transmitter and associated equipments may be provided with the technical offer.

(v) 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.

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

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

2.13 REMOTE CONTROL AND TELEMETRY SYSTEM:

2.13.1 The transmitter shall be controllable from distant location with SNMP over TCP/IP via a telecom or network connection as well as locally with password protection and works with any PC/laptop or smart phone. The screens should be clear and intuitive to the operator. The screen layout should contain mimic diagram of AC mains flow and Audio/RF flow separately. Preferably, each unit may have its own screen in a block diagram style for quick location of faults. The ports for remote PC and local PC should be separate so that both can operate simultaneously.

2.13.2 The Remote control and Telemetry system should be capable for controlling and monitoring various parameters of FM transmitter and automatic changeover unit from a distant location.

2.13.3 All technical parameters motioned for remote control and telemetry system should also be made available in any port through serial commands and physical points.

2.13.4 Details of monitoring, control parameters, indications & metering etc. shall also be given by the tenderer.

2.13.5 Software and allied equipments for remote control and telemetry shall be part of the supply of the transmitter. The broadband connection shall be provided by AIR.

2.13.5 MIB files will be provided by tenderer.

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	256KF8E
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	≥ 10 kW continuous
3.2.2	Output (Load) Impedance	50 Ω unbalanced.
3.2.3	Permissible VSWR	1.5: 1 with full power; 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. The actual values are to be indicated.
3.2.5	**(a) Overall Efficiency (AC to RF Out) for FM (Analog) Mode only**	≥ 70 %.
	(b) Overall Efficiency (AC to RF Out) for HD Mode only	
	(i). HD only (-20dB)	≥ 45 %.
	(ii). HD only (-14dB)	≥ 40 %.
	(iii). HD only (-10dB)	≥ 38 %.
	(c) Overall Efficiency (AC to RF Out) for (FM + HD) Mode	
	(i). [FM + HD (-20dB)]	≥ 55 %.
	(ii). [FM + HD (-14dB)]	≥ 45 %.
	(iii). [FM + HD (-10dB)]	≥ 40 %.
	(d) Overall Efficiency (AC to RF Out) for DRM+ Mode only	
	(i). DRM+ Mode only (-20dB)	≥ 45 %.
	(ii). DRM+ Mode only (-14dB)	≥ 40 %.
	(iii). DRM+ Mode only (-10dB)	≥ 38 %.
	(e) Overall Efficiency (AC to RF Out) for (FM + DRM+) Mode	
	(i). [FM + DRM+(-20dB)]	≥ 55 %.
	(ii). [FM + DRM+ (-14dB)]	≥ 45 %.

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	(iii). [FM + DRM+ (-10dB)]	≥ 40 %.
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. 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
3.3.3	Analog and AES/EBU input Level for ± 75kHz (peak) Deviation:	**ANALOG AUDIO INPUT:** Input Level adjustable from -6 dBu to + 6 dBu. **AES/EBU AUDIO INPUT:** Input Level adjustable from -15 dBFS to 0 dBFS
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 75dB
3.5.2	Total Harmonic Distortion plus Noise (THD+N) (30 Hz to 15 kHz)	Better than 0.1%
3.5.3	Inter Modulation Distortion (IMD) SMPTE(60 Hz/7 KHz, 4:1)	Better than 0.1%
3.5.4	Amplitude Response (30 Hz to 15 kHz)	Better than or equal to ± 0.1 dB
3.5.5	Dynamic/Transient Intermodulation Distortion (DIM/TIM) (2.96 kHz Square Wave/14 kHz Sine Wave)	Better than 0.1%
3.6	**STEREO OPERATION :**	
3.6.1	Stereo Separation at ±75kHz Deviation (30 Hz to 15 kHz)	Better than 60 dB
3.6.2	Linear Cross Talk referred to 100% modulation (30 Hz to 15 kHz)	Better than 50 dB
3.6.3	Non-linear Cross Talk referred to 100% modulation.	Better than 50 dB
3.6.4	FM S/N Ratio at ±75kHz Deviation (L or R)	Better than 75 dB

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	(30 Hz to 15 kHz) rms, unweighted (22 Hz - 22 kHz)	
3.6.5	Total Harmonic Distortion Plus Noise (THD + N) (L or R) (30 Hz to 15 kHz)	Better than 0.1%.
3.6.6	Inter Modulation Distortion IMD SMPTE (L or R) (60 Hz/7 kHz, 4:1)	Better than 0.1%.
3.6.7	Amplitude Response (L or R) (30 Hz to 15 kHz)	Better than or equal to ± 0.1 dB
3.6.8	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 75 dB
3.7.2	Total Harmonic Distortion Plus Noise (THD + N) (30 Hz to 15 kHz)	Better than 0.1%
3.7.3	Inter Modulation Distortion IMD (SMPTE) (60 Hz/7 KHz, 4:1)	Better than 0.1%
3.7.4	Amplitude Response (30 Hz to 100 kHz)	Better than or equal to ± 0.1 dB
3.7.5	Dynamic/Transient Intermodulation Distortion (DIM/TIM) (2.96 kHz Square Wave/14 kHz Sine Wave)	Better than 0.1%
3.8	Turn Around Loss	Better than 20 dB (Measurement set-up should be enclosed with the tender documents).
3.9	**DIGITAL (DRM+/HD Radio) OPERATION:**	
3.9.1	MER (Modulation Error Ratio) for HD Radio	≥ 14dB
3.9.2	MER (Modulation Error Ratio) for DRM+	≥ 21 dB @ DRM+ @ 16-QAM & ≥ 13 dB @ DRM+ @ 4-QAM

3.8 TECHNICAL SPECIFICATIONS OF REMOTE CONTROL AND TELEMETRY SYSTEM:

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
1.	Remote Control and Telemetry (Controllable Settings/Parameters)	1. Transmitter: ON/OFF 2. Exciter: ON/OFF 3. Exciter1/ Exciter 2 selection 4. RF Output Power Level Control 5. Audio input level 6. Selection of Transmitters 1/2.
2.	Remote Control and Telemetry (Monitorable Settings/Parameters)	1. RF forward and reflected power of each Exciter 2. RF forward and reflected power of each Power Amplifier 4. Power supply status i.e. Voltages, Currents etc. 5. Alarm Indications: Temperature, VSWR, ON AIR, Audio etc. 6. Any other parameters which the manufacturer considers essential for proper control /functioning of a remote-controlled FM transmitter.

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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.	General Purpose PC (Computer System)	Latest generation, Intel Core i7 processor equivalent or higher, minimum 19" LCD/LED Flat Screen, 8 GB RAM, Windows-10 or latest Operating System, HDD $\geq$ 1 TB, DVD-RW, 4 USB ports & Card Reader.
6.	Software and Hardware Items	Complete software, hardware items, accessories, cables, connectors, Extension cables etc. (Details of offered items are to be given by the tenderer)

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SECTION-IV
TECHNICAL SPECIFICATIONS OF ASSOCIATED EQUIPMENTS/ITEMS

SECTION-IV(A) - TECHNICAL SPECIFICATIONS OF 15 kW AIR COOLED DUMMY LOAD

4.1

Dummy Load: One number, 15kW forced air cooled Dummy Load, 50 Ω are to be quoted for transmitter as per technical specifications given below.

All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.

DUMMY LOAD-15 kW

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATION
4.1.1	Power Rating	15 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 FORWARD & REFLECTED power measurement suitable for mounting in 19" rack with separate Transducers/Sensing elements for measuring forward (≤ 15 kW) & reflected (≤ 1.5 kW), elements sockets, line section and 3-1/8" EIA flanges including all accessories, cables complete (2 Nos.) with Adapter Kit as per specifications for connecting with the rigid line. All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.	1 Set
4.1.12	Power Rating: Forward Power	15 kW continuous
4.1.13	Power Rating: Reflected Power	1.5 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

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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 also work in manual mode. The switch should be equipped with a visual position indicator and emergency knob for manual switching. All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
4.2.1	No. of Ports	4
4.2.2	Input Ports (two), Output Port(one), Termination/Dummy Load Port(one)	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	≤ 0.1 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.
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.
Ferrite-Core of reputed make (Fair-Rite etc.) suitable for 3-1/8" RF coaxial copper rigid line should be provided for protection against RFI/EMI.

4.3.1 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. All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.
The tenderer is also required to submit certificates from recognized laboratory testifying the composition of materials used for RF coaxial copper rigid lines and associated accessories.

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATION	TECHNICAL SPECIFICATION
4.3.1	Size	1-5/8"	3-1/8"
4.3.2	Attenuation @100 MHz at 20°C	$\leq$ 0.70 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	Aluminium/Aluminium alloy	Aluminium/Aluminium alloy
4.3.8	Material for Inner Conductor for Elbows, Adapters and for all the entire support inner bullets	Silver-plated brass/ Silver-plated Aluminium	Silver-plated brass/ Silver-plated Aluminium
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 Supply of One Set of 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration & Associated Equipments/items {The tenderer must quote all items}

S. No.	Description	Make	Model	Qty.	Unit
(1)	(2)	(3)	(4)	(5)	(6)
1.	(i). Supply of 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration including 2 Nos. of Exciter units in total, against both the transmitters as per AIR Specifications. Each transmitter shall be capable of giving ≥ 10 kW continuous power.			1	Set
	(ii). Supply of Remote Control & Telemetry Equipment as per AIR specifications including complete software, hardware, cables, connectors, extension cables, accessories etc. (Details of offered items are to be given by the tenderer).			1	Set
	(iii). Supply of Automatic changeover unit for 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration complete with all accessories as per specification.			1	Set
2.	Supply of General Purpose PC suitable for Remote Control & Telemetry Equipment complete as per AIR specifications (COTS item)			1	Sets
3.	Supply of complete installation material as given below for each transmitter 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 in Section-IV [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 line (complete with outer, inner & insulators)			18	Mtrs.
3.2	3-1/8" Un-flanged 90º Elbow with equal leg (complete with outer, inner & insulators)			8	Nos.
3.3	3-1/8" Clamp type Coupling (complete with outer, inner & insulators)			12	Nos.
3.4	3-1/8" to N Test Reducer			2	Nos.
3.5	1-5/8" to N Test Reducer			2	Nos.
3.6	3-1/8" Field Flange (Clamp type)			7	Nos.
3.7	3-1/8" to 1-5/8" reducer /adapter			2	Nos.
3.8	Hanger for 3-1/8" RF coaxial copper rigid line			12	Nos.
4.	Supply of 15 kW Forced air cooled Dummy Load, 50 Ω as per AIR specifications.			1	Set
5.	Supply of RF Power Meter (dual type) with simultaneous FORWARD & REFLECTED power measurement suitable for mounting in 19" rack with separate Transducers/Sensing elements for measuring forward			1	Set

	(≤ 15 kW) & reflected (≤ 1.5 kW), elements sockets, line section and 3-1/8" EIA flanges including all accessories, cables complete (2 Nos.) with Adapter Kit as per specifications for connecting with the rigid line.				
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
7.	Supply of Ferrite-Core of reputed make (Fair-Rite etc.) suitable for 3-1/8" RF coaxial copper rigid line for protection against RFI/EMI.			1	Set
8.	Supply of Ferrite-Core of reputed make (Fair-Rite etc.) for the power supply input terminal for protection against RFI/EMI.			1	Set
9.	Any other items/accessories for equipment/items at S. No. 1 to 8 offered, for the completeness of the system. Items wise details (including part number, if any) are to be given by the tenderer)			1	Set
10.	Inspection charges at manufacturer's works of transmitter as per AIR specifications.			1	Lot
11.	Technical manuals {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 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration, Automatic changeover unit, Dummy Load, thru line power meter, Motorized RF coaxial switch, RF Coaxial Copper Rigid line, Remote Control & Monitoring Equipment etc. along with one soft copy on CD shall be supplied as per distribution given below:				
11.1	For DDG (E-FM), P & D Unit, DG: AIR, New Delhi-110001 {Within One Month of issue of Acceptance of Tender) **(irrespective of number of transmitters to be ordered)**			1	Set
11.2	For Consignee {To be supplied along with the equipment}			2	Sets
11.3	For the following Offices/Officers, Technical manuals are to be supplied along with the equipment as per distribution given below) **(irrespective of number of transmitters to be ordered)**			9	Sets
	(i) DDG (E-FM), P&D Unit, DG:AIR - 1 Set				
	(ii) Zonal Office (Project Wing) NZ & NEZ - 2 Sets				
	(iii) Zonal Office (Maintenance Wing) NZ & NEZ - 2 Sets				
	(iv) DDG (E-TM), DG: AIR - 1 Set				
	(v) Technical Library, P&D Unit, DG:AIR - 1 Set				
	(vi) NABM (Technical), Delhi - 1 Set				
	(vii) R&D, New Delhi - 1 Set				
	Total - 9 Sets				

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SECTION-V(B)

Schedule of Requirements/Materials (Un-Priced) for Supply of One Set of 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled) in (1+1) configuration & Associated Equipments/items (OPTIONAL ITEMS)

(*Not to be considered for ranking purpose*) {The tenderer must quote all items}

S. No.	Description	Make	Model	Qty.	Unit
	Recommended spares for one set of transmitter & associated equipments/items**: State NA, if not applicable**				
1.	10 kW Digital Compatible VHF FM Solid-State MOSFET technology based Broadcast transmitter (Liquid Cooled) having capable of giving ≥ 10 kW continuous power, including 2 Nos. of Exciters as per AIR Specifications.			1	Set
2.	IPA module complete, if applicable			1	Set
3.	RF Pallet of IPA module, if applicable			1	Set
4.	Power Supply Unit for IPA module, if applicable			1	Set
5.	PA module complete			1	Set
6.	RF Pallets of PA module, if applicable			1	Set
	(i)….			1	Set
	(ii)….			1	Set
	(iii)….			1	Set
	…..			1	Set
	…..			1	Set
7.	Control PCB of PA module			1	Set
8.	Power Supply Unit(s) for PA module			1	Set
9.	MOSFETs for PA module			1	Set
10.	Exciter Unit Complete			1	Set
11.	Control PCB of Exciter Unit			1	Set
12.	Audio PCB of Exciter Unit			1	Set
13.	RF Amplifier PCB of Exciter Unit			1	Set
14.	Power Supply Unit for Exciter Unit			1	Set
15.	Complete Control Unit (s)			1	Set
16.	Changeover Unit for Exciter			1	Set
17.	Power Combiner of final stage of 10 kW Digital Compatible FM Transmitters			1	Set
18.	Absorbers			1	Set
19.	Automatic change over unit for 10 kW Digital Compatible FM Transmitters (Liquid Cooled) in (1+1) configuration.			1	Set
20.	Remote control and telemetry System			1	Set
21.	Thru Line power meter complete unit			1	Set
22.	15 kW forced air cooled Dummy Load, 50 Ω Complete Unit			1	Set
23.	Blower Unit for Dummy Load			1	Set
24.	Resistors for Dummy Load			1	Set

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25.	Motorized RF coaxial changeover switch complete			1	Set
26.	Complete Cooling system of transmitter			1	Set
27.	Heat Exchanger of cooling system			1	Set
28.	Pump of cooling system			1	Set
29.	Fan of cooling system			1	Set
30.	Coolant for cooling system (Rate per Litre to be quoted)			1	Litre
31.	Any other recommended spares (Items wise details of offered and included material, items & part are to be given by the tenderer).			1	Lot

All India Radio at its own discretion may procure spares for a value not exceeding 10% of the cost of equipments. The tenderer should quote all the essential spares.

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ANNEXURE-I

INSPECTION DETAILS

The inspection for acceptance of the transmitter equipment on dummy load (being supplied alongwith the transmitter) will be carried out at Manufacturer's Works 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 Manufacturer. Complete details and specifications of the transmitter will be checked and all parameter values will be measured.

The tenderer is also required to demonstrate the digital compatibility of the offered VHF FM transmitter in HD **OR** DRM+ mode. All measurements applicable for HD/DRM+ mode shall also checked as per AIR specifications. All necessary equipments required for this purpose will be arranged by the tenderer.
All the spares ordered as per AT will be tested in actual circuit at Manufacturer's Works by Engineers of AIR.
Testing/measurements including operational & functional checking of all the transmitters shall be carried out at three different frequencies in addition to 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.
Tenderer shall also arrange for the photographs of inside of transmitter's cubicle which will be attached with the ATP/Inspection report.

Testing/measurements including Operational & functional checking of the transmitter will be carried out at Manufacturer's Works 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 at Manufacturer's works 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 in addition to 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, graphical printout, notes and figures must also be available at the factory at the time of inspection.

10% of the randomly selected RF coaxial copper rigid lines and accessories shall be tested at the same place where PDI of the transmitter will be done, to ensure the performance parameters i.e. attenuation & power handling capability of the RF coaxial copper rigid lines and accessories. The OEM of the transmitter should have the facility to test the RF coaxial copper rigid lines and accessories.

Remaining 90% of RF coaxial copper rigid lines and accessories will be accepted on the basis of OEM test certificates (as per AIR specifications) duly stamped and signed by OEM on their letterhead, failing which, test certificates will be considered incomplete and equipment offered by the firm is liable to be rejected.

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The OEM test certificates in respect of RF coaxial copper rigid line should also enclosed with certificates from recognized laboratory testifying the composition of materials used for RF coaxial copper rigid lines and associated accessories.

All other associated equipments/items i.e. Dummy Load, Motorized RF coaxial switch, etc. will be accepted on the basis of OEM test certificates (as per AIR specifications) duly stamped and signed by respective OEM on the letterhead of the OEM, failing which, test certificates will be considered incomplete and equipment offered by the firm is liable to be rejected.

All OEM test certificates are also to be submitted by the tenderer to All India Radio along with the call for inspection for analyzing etc. These OEM test certificates must also be available at the time of inspection at OEM's Works.

Following information should also form part of above data which will also be checked for each transmitter during inspection by AIR representatives **at transmitter Manufacturer's works:-**

1. Origin of Country, Make, Type, Model & name of all units of transmitter, other items & accessories 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. Automatic changeover of Exciter and IPA (if applicable) etc.
6. Checking meter readings and calibration.
7. Checking of control and protection system of transmitter.
8. Checking of all power levels, meters, LEDs etc.
9. Checking of RF voltages on test points.
10. Inter-changeability of Pas, sub-modules.
11. Exciter operation, checking and measurements.
12. Working of Exciter in all mode including modulating inputs as per specifications.
13. Measurement of levels in the whole AF and RF chain.
14. Checking of all spares, PCB's, modules for the respective transmitter, other items & accessories.

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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 10 kW RF output:	…….. kW …….. BTU/ Hr		
4.0	Transmitter Air –conditioning requirement:	…….. TR		
5.0	Number of racks:	……. Number		
6.0	Size of racks: Transmitter rack dimensions:	Width: ……(mm)	Height: ……(mm)	Depth: ……(mm)
7.0	Size of Heat Exchanger of cooling system	Width: ……(mm)	Height: ……(mm)	Depth: ……(mm)
8.0	Pumps of cooling system: (Total No. of pumps)	……. Number		
9.0	Fan of cooling system (Total No. of fans)	……. Number		
10.0	Full required quantity of coolant for cooling system (against one 10 kW FM Tx.)	……. Litres		
11.0	Power consumption at 10 kW RF output:	…….. kW		
12.0	**Typical Power supply line voltages (phase to phase voltages)**			
12.1	Voltage between Red phase & Yellow phase:	…… Volt		
12.2	Voltage between Yellow phase & Blue phase:	…… Volt		
12.3	Voltage between Blue phase & Red phase:	…… Volt		
13.0	**Typical Power supply phase voltages (phase to neutral voltages)**			
13.1	Voltage between Red phase & Neutral:	…… Volt		
13.2	Voltage between Yellow phase & Neutral:	…… Volt		
13.3	Voltage between Blue phase & Neutral:	…… Volt		
14.0	**Typical Power supply line current/phase current**			

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14.1	Line current/Phase current (Red phase):	…… Amp.
14.2	Line current/Phase current (Yellow phase):	…… Amp.
14.3	Line current/Phase current (Blue phase):	…… Amp.
14.4	Neutral current:	…… Amp.
15.0	Power factor:	……

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ANNEXURE-III

PERFORMA FOR INFORMATION ABOUT LOCAL OFFICE FOR AFTER SALES SUPPORT

1.	Address of Local Office	
	Telephone (Landline) No.	
	Mobile No.	
	E-mail Address	
2.	Address for communication (if different)	
3.	Legal Status (Authorized Representative/ liaison office/registered company etc.)	
4.	Name, address, contact number (Mobile number) & e-mail address of Local representative	
5.	Brief details of Technical facilities available for after sales support: The details of technical facilities in the local after sales support office, 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: Executed at : Executed by :

(Authorized Signatory of local office) Name : Signature :	**(Authorized Signatory of transmitter OEM)** Name : Signature :
Place and Date:	Place and Date:

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List of Places for Supply of 10 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter (Liquid Cooled):

S. No	Name of Places	State
1.	Guwahati	Assam
2.	Haldwani	Uttarakhand
3.	Kotputli	Rajasthan
4.	Kokrajhar	Assam

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