

**PRASAR BHARATI  
(BROADCASTING CORPORATION OF INDIA)  
DIRECTORATE GENERAL; ALL INDIA RADIO  
(PLANNING & DEVELOPMENT UNIT)**

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F.No.5kW Digital Compatible VHF FM Tx/Spec.-32/5/4/3/2010-D (TD/FM)

**SPECIFICATIONS FOR SUPPLY OF 5KW DIGITAL COMPATIBLE VHF FM SOLID STATE BROADCAST TRANSMITTER ALONGWITH ASSOCIATED AUXILIARY EQUIPMENT.**

**INTRODUCTION:** This Specification is for Supply of 5kW DRM<sup>+</sup> Compatible VHF FM Solid State Broadcast Transmitter using MOSFET technology and associated DRM<sup>+</sup>Compatible auxiliary equipment to be installed at various sites in AIR network under 11<sup>th</sup> Plan.

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N.B.

1. The Tenderer should submit schedule of material /requirement of Supply without *price in the same format as given as in Section-I* of indenter Specification in the technical bid, failing which the tender shall be considered incomplete and is liable to be rejected.
2. Each statement of this specification has to be complied with & supported by printed technical literature , technical data sheets and technical manuals from the manufacturer of the equipment by the

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tenderer, to assess the merit of the offer without which tender will be considered incomplete & is liable to be rejected. The tenderer should make a detailed offer.

3. All the technical details, Schematic drawings must be submitted and enclosed with the tender by the tenderer failing which the tender is liable to be rejected.
4. The tenderer should submit the tender offer to AIR in the format given below Section wise & clauses wise in respect of all the sections of technical specifications {along with column number 5 “Ref to tender page No. by the tenderer as per the offer of the tenderer” in the format given below} in detail to assess the full merit of the offer, failing which tenderer shall be considered incomplete and is liable to be rejected.

Sr. No. of AIR Spec. Section wise & Clause wise (1)	Details of AIR Spec. Part/ Section wise & clause wise (2)	Make & Model No of the Equipment offered (3)	Compliance Yes/NO (4)	Ref to tender page No. by the tenderer as per the offer of the tenderer (5)	Remarks (6)
Section-I Clause wise					
Section-II Clause wise					
Section-III Clause wise					
Section-IV Clause wise					
Section-V Clause wise					
Annexure-I					

5. Tenderer should quote the rate / cost of individual items in the tender offer while submitting the offer for spares in commercial bid.
6. The complete Technical specification (section wise & clause wise) compliance statement along with schedule of requirements/materials (unpriced) must be signed & stamped on each page by the Original Equipment Manufacturer (OEM) of the equipment in the tender document including the clarifications, if any, asked by the Indenter. In case tender offer is from other than the Original Equipment Manufacturer, the tenderer must also sign & stamp each page of the complete Technical specification (section wise & clause wise) compliance statement including the clarifications, if any, asked by the Indenter, failing which the tender shall be considered incomplete and is liable to be rejected. The OEM & tenderers should fill up their name in CAPITAL LETTERS, full address with pin code, phone number, fax number, e-mail address and with their full signatures.
7. The complete tender shall be page numbered.
8. Optional items will not be considered for ranking purposes.
9. The authorization and Guarantee must be given by 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. The authorization and Guarantee will be considered from Original Equipment Manufacturer (OEM) and Guarantee from tenderer only. The authorization and Guarantee other than OEM and guarantee other than tenderer in the tender will not be considered, failing which the tender shall be considered incomplete and is liable to be rejected.

10. Any change in the AIR Technical Specification format or language or in parameters or of any other nature including the deletion of technical specification clause, words, lines in the technical compliance statement as mentioned in clause 6 as above by the Original Equipment Manufacturer/ tenderer will not be acceptable to Indenter and the tenderer is liable to be rejected.
11. Tenderers may please note that no clarifications may be asked by the Indenter regarding Indenter technical specifications, so all the tenderers may submit their tender offers accordingly.

**SECTION- I GENERAL**

The broad scope of the supply and schedule of requirement is as follows:

- 1.0 5kW DRM<sup>+</sup> Compatible VHF FM Broadcast MOSFET based technology Transmitter shall be capable of continuous round the clock operation having two numbers of Exciters complete as per AIR Specification including all equipment/items i.e. schedule of requirements/materials (unpriced) under Section –V (A & B).  
Transmitter shall be complete in itself and integrated in Standard rack and shall be supplied with Auxiliary Equipment. Transmitter shall be field proven for satisfactory operation.
- 1.1 **The following are excluded from the scope & will be provided by Indenter:**
- 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 Electric 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 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 and measures and quantities shall be in metric units.
- 1.4 **INFORMATION TO BE SUPPLIED WITH THE TENDER IN DUPLICATE:**
- 1.4.1 A **Compliance Statement** to the complete specification of AIR, para wise, for each clause.
  - 1.4.2 Complete **printed technical literature/data sheet/ detailed information** including technical manual of transmitter and associated auxiliary equipment/item as per Section -V (A & B) from the Original Equipment Manufacturer (OEM) in support of compliance statement should be furnished for all the items of the tender, to assess the full merit of the offer, without which the tender will be considered incomplete and is liable for rejection
  - 1.4.3 Detailed Schedule of Requirement/Materials offered for Supply of the Transmitter, Auxiliary Equipment & accessories for each transmitter should be in conformity with Section -V (A & B) without any change in format without price (un-priced) failing which the tender shall be considered incomplete and will be liable for rejection.

**The tenderer must quote all items.**

- 1.4.4 Country of origin, make, type, model number in respect of all items should be submitted alongwith the name & address of their vendors.
- 1.4.5 Layout of Transmitter equipment including dimensions and photographs of the interior of the Transmitter.
- 1.4.6 Transmitter Block diagram/ Schematic drawings and its subsystems.
- 1.4.7 Information and characteristics of all high power semiconductor devices used in the Equipment.
- 1.4.8 A supply record of 5 KW VHF FM transmitters power wise and year wise in the last 5 years shall be enclosed by the tenderer. Names, Address, E-mail, telephone nos. and Fax numbers of customers must be given.
- 1.5 INFORMATION TO BE SUPPLIED BY THE TENDERER AFTER AWARD OF SUPPLY ORDER : One set of Technical manuals {for Installation, testing, commissioning , Operation & Maintenance, including Theory of operation and fault diagnosis printed and duly bound for 5kW DRM<sup>+</sup> VHF FM transmitter, Dummy Load and thru line power meter etc. RF Coaxial Copper Rigid line, Remote Control & Monitoring System - along with one soft copy on CD shall be supplied to “The Director Engg. (Projects), P & D Unit, DG: AIR, New Delhi-110001”
- 1.6 INFORMATION TO PRECEDE DESPATCH OF EQUIPMENT:  
Following information should be supplied to the Director Engg. (Projects), P & D Unit, DG: AIR and each of the consignee, two months prior to dispatch of Equipment:
- a) Detailed list of equipment under dispatch.
  - b) Photograph showing location of components in the various units and sub units with item numbers marked thereon.
- 1.7 INFORMATION TO BE SUPPLIED ALONG WITH EQUIPMENT:
- 1.7.1 For each Transmitter, Auxiliary Equipment and all other equipment/items & accessories **two** printed & duly bound copies of Technical manuals as per clause 1.5 as above along with Inspection Report and OEM test certificate of associated equipment and soft copy are to be supplied to each consignee.
- 1.7.2 These Technical manual documents as per clause 1.5 as above along with Inspection Report & other OEM test certificates are required to be sent (irrespective of number of transmitters ordered) to the officers / offices / places as per SECTION - V (A).
- 1.8 DELEVERY PERIOD: 8 (Eight) months from the date of placement of purchase order.
- 1.9 GUARANTEE:  
Tenderer shall submit with his tender an undertaking to accept the following guarantees:
- (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 30 days at tenderer's expense any component which becomes defective under normal operating conditions within 18 months from the date of acceptance of Equipment at respective site or 12 months from the date of commissioning at site whichever is earlier.
- (iii) A guarantee to supply all components for a period of ten years from the date of acceptance of Transmitter at site, at rates at which these are being supplied by him to other customers and also should match prices of original manufactures of these components prevailing at that time.
- (iv) If at any stage during next 10 years, the manufacturer stops production of this model of transmitter, he shall intimate All India Radio in advance to enable the latter to stock the critical items.

1.10 INSPECTION:

- 1.10.1 Detailed inspection of Transmitter equipment on dummy load (as per Formal AT) will be carried out at Manufacturer's Works by Engineer(s) of All India Radio as per detail given in Annexure-I.

Prior intimation for carrying out Inspection at Works is to be given by the Tenderer to the indenter at least 6 weeks in advance. Inspection period for Transmitters will be two days for first transmitter and one day each for subsequent numbers of transmitters.

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

- 1.10.2 The all other equipment associated /auxiliary Equipment & accessories i.e. Equipment/items at SECTION V (A) S NO. 5.2, 5.5, 5.6 & SECTION V (B) (Applicable, in case, these are part of Order) S NO. 5.11 will be accepted on the basis of Original equipment manufacturer's test certificate (OEM's) and received at site by ultimate consignee, in good condition.
- 1.10.3 OEM test certificates duly stamped and signed by OEM in respect of all equipment as per SECTION-IV are to be submitted by the tenderer to the indenter before giving call for inspection.
- 1.10.4 Acceptance Test Procedure (ATP) will be submitted by the Tenderer within one month of placement of order for approval of Indenter in respect of Transmitter and all other equipment /items as per Section -IV for the approval of Indenter. This will include all tests so as to assess the performance of the equipment as per specifications.
- 1.10.5 Inspection will be carried out as per approved ATP.

1.11 TRAINING: At AIR Site (OPTIONAL).

The tenderer shall train 10 AIR engineers for 3 working days **at one** of AIR Sites to enable them to become acquainted with all particulars as well as installation, operation, trouble shooting and maintenance of the Transmitter, Auxiliary Equipment & accessories. The training programme will be structured so as to cover theory of operation Maintenance, Practical demonstrations of circuits, Maintenance demonstrations, Fault finding, Circuit

Tracing exercises and Part Replacements. (Irrespective of number of transmitter ordered).  
For Training of AIR Engineers expenses toward to and fro air journey, boarding, lodging etc. will be borne by All India Radio.  
Two sets of training lecturers notes, schematic drawing, hand book etc. shall be supplied to DE (Project) P&D Unit, DG: AIR.

**1.12 AFTER SALES SERVICE**

**SERVICE FACILITY:** The Tenderer shall specify the repair/service facility available for the equipment in India with address, Phone/Fax nos., E-mail etc. The supply of transmitter may require after sales services. Therefore full details of facilities for carrying out after sale service may be given.

1.13 In support of Tenderer's claim an "up-to-date" list of their customers including their full address, Telephone/Fax No & E-mail address is required to be submitted along with complete set of actual performance figures i.e. Performance measurement taken on transmitter and all other equipment/items are to be furnished along with the tender.

The offered equipment/items as per SECTION –V (A & B) *shall* be field proven for satisfactory operation. A supply record of transmitter year wise in the last 5 years may be enclosed by the tenderer.

**1.14 ENVIRONMENTAL CONDITIONS for transmitter and all associated equipment:**

Ambient temperature range for operation :	0° C to +45° C
Relative humidity:	95 percent, non condensing.
Working altitude:	Up to 3000 meters AMSL

**1.15 Power Supply for Three Phase Equipment:**

Operating Line Voltage:	AC Three phase, 4 wire, 400V $\pm$ 10 %,
Frequency:	50Hz $\pm$ 4 %
Power Factor:	Better than 0.9

**1.16 Power Supply for Single Phase Equipment:**

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

## SECTION II

### TECHNICAL DESCRIPTION OF TRANSMITTER

#### 2.0 TRANSMITTER CONFIGURATION:

- a) 5kW DRM<sup>+</sup> Compatible VHF FM broadcast solid state MOSFET technology Transmitter without tuning (frequency agile) shall be capable of giving  $\geq 5$  kW power continuously. It should consist of a number of low power hot pluggable modular power amplifiers.
- b) The Transmitter will be provided with 2 (two) numbers of Exciter units. The second Exciter unit will work as hot or active standby in automatic change over mode (with manual override) which will also incorporate auto audio changeover.  
The automatic changeover of exciter should take place when power of active exciter goes down by  $\geq 3$  dB.
- c) The Transmitter will be complete in all respects. Indenter will provide power supply of three phase as per Section-I at a single point. All other transmitter's inbuilt subsystem shall drive 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.**

- d) The Transmitter should be suitable for unattended 24 x7 operations.
- e) Transmitter equipment shall be housed in a rack having pleasing appearance. All metal works shall be protected against rust and corrosion. All materials shall be Non-inflammable and fire retardant.
- f) All stages i.e. Exciter, IPA (as the case may be), PAs, Combiner, harmonic filters, etc. should be capable of operation in the entire VHF frequency band i.e. 88 to 108 MHz **without** change of components/settings/tuning.
- g) The Transmitter shall be suitable for Mono and Stereo FM Radio Broadcast.
- h) 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.
- i) 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, 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.I. (Electro Magnetic Interference) as per ETS-300447.
- j) It should comply with IEC 215 safety standards so as to eliminate hazards to personnel. Access to parts carrying dangerous voltage shall be through interlocked doors.
- k) The Transmitter will consist of solid state devices and have only 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 to full value from front panel control on controller. Details to be provided by tenderer.
- l) The transmitter should be DRM<sup>+</sup> Compatible.(As per ETSI standard amended up to date)

**2.1 Exciter:-**

- 2.1.1 The Exciter should have Digital Signal Processing. It should accept analog mono, analogue stereo (left and right) / encoded stereo signals (MPX), DARC, SCA inputs and AES / EBU digital inputs. It should be compatible for mono and Stereo Broadcasting using pilot tone system conforming to ITU-R, Rec.450.
- 2.1.1.1 All the input modules mentioned in 2.1.1 must be included in the offer of Exciter i.e either inbuilt or separate input modules to be used in one or same slot (Digital 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, DC voltages & currents, on its panel meters or LCD display. Status and faults should also be indicated. List of meters / display, measured parameters, LED's & status/fault indications to be enclosed.
- 2.1.4 It should be Synthesized with easy channel selection of minimum 100 KHz spacing i.e. can be operated on any of the FM channels from 88 MHz to 108 MHz in VHF Band-II. The Exciter should be **"Frequency agile"** --- 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 manufacture): 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 frequency band, 88 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", "over-temperature", "over-drive" and "air-flow" failure. The efficiency figures for each IPA are to be indicated.

- 2.3 Power Amplifier Modules:** Total transmitter output power will be developed by an optimum combination of PA Modules and should be capable of operation in the entire VHF frequency band, 88 to 108 MHz **without tuning**.

Each of the 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 "air-flow" failure. The efficiency figures for each PA are to be indicated.

- 2.4 Combiner Unit:** The final power combiner shall be of such type so as to be capable to operate in entire 88-108 MHz without any tuning & change of components/settings.

Tenderer shall offer 5 KW DRM<sup>+</sup> Compatible VHF FM transmitter in a single Unit. No other

combination shall be acceptable.

The Insertion & Return **Loss figures** with full details of the combining unit along with **schematic diagrams** shall be enclosed with the tender.

Tenderer in the following format shall indicate the reduction in transmitter RF output power in case of failure of individual power amplifier module units.

SNo.	Number of PA modules/units failure	Transmitter RF output power in kW
1.	one No.	..... kW
2.	two Nos.	..... kW
3.	three Nos.	..... kW
....	....	..... kW
N	N...Nos.	..... kW

2.5 **Final Output Harmonic Filter** for Transmitter: The final Output / Harmonic Filter should be capable of operation in the full VHF Band 88 to 108 MHz without **tuning**. 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 Over load protection against over currents, 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 blower failure and less volume of cooling air.
- 2.6.4 Protection against higher VSWR including open and short conditions at output.
- 2.6.5 Immediate power foldback under severe / damaging fault conditions of VSWR. The power of transmitter should automatically come down to a suitable safe design limit, so that the transmitter and its subsystem does not get damaged due to load mis match. Details of fold back to be provided.
- 2.6.6 Transmitter should be protected against lightning by providing DC / RF discharge path and details are given in the tender.

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	<b>INSTRUMENTATION &amp; INDICATIONS :</b>
	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. Numbers 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 – Numbers of LED’s or Display for “ <b>status indication</b> ” and “ <b>fault indication</b> ” to be indicated in tender.
2.8.2	Suitable test points for operational check outside the module shall also be provided.
2.8.3	RF outputs (Forward and Reverse) should be provided on connectors for performance measurement.
2.9	<b>COOLING SYSTEM:</b>
	Full details of cooling system and blowers shall be given. Temperature rise of air for rated power output is to be indicated. Details of cooling system and filters shall be given. Blowers used must be within the Transmitter cubicles.
2.10	<b>TRANSMITTER POWER SUPPLY:</b>
	The Transmitter shall be complete in all respects. AIR shall provide three phase power supply system as per Section-I at a single point. All the power supply required for the Transmitter and its auxiliary equipment should be derived from the same point.
	The rectifier and filter circuits should be able to take care of switching voltage surges on power lines. The AC and DC supply should have their protective devices. 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.
2.11	<b>SPARES (OPTIONAL):</b> The tenderer shall quote for one set of spares based on failure pattern as per section V (B).
2.12	<b>REMOTE CONTROL AND TELEMETRY SYSTEM/VSAT/DIALUP CONNECTION: (OPTIONAL)</b>
	The transmitter shall be controllable from distant location using dial up connection, internet based IP address technique as well as locally. The PCs, modems, and allied equipment for this shall be part of the Supply of the transmitter. The telephone connection for the “dial up facility” shall be provided by AIR.
	It shall be a Web based system for remote control and monitoring various parameters of FM transmitter and associated auxiliary systems from a distant location. System shall be such that an engineer sitting at a distant location is able to control and monitor various FM transmitters located at different places of the country by connecting the PC to the web through telephone lines (Via broadband connection etc.) as well as using a dial-up connection through modem.
2.12.1	Transmitter should be provided with Remote Control and Telemetry Interface Card and equipment to operate it from a distant/centralized location via ISDN/Digital line/TCP-IP/ PSTN network/Dialup Connection.
2.12.2	The transmitter should be capable of operation with general purpose PCs with Modems. Users can

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	dial-in to the stations using the remote control software running on a PC from a remote place to operate and monitor the Transmitter System.
2.12.3	The Remote Control software should be Graphical User Interface based and 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.
2.12.4	Details of control parameters & indications/metering shall be given.

**SECTION-III TECHNICAL SPECIFICATIONS OF TRANSMITTER**

<b>SNo.</b>	<b>TECHNICAL PARAMETER</b>	<b>TECHNICAL SPECIFICATION</b>	<b>COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos</b>
<b>3.1</b>	<b>GENERAL</b>		
<b>3.1.1</b>	Frequency Range	88 to 108 MHz	
<b>3.1.2</b>	Nominal Frequency deviation	$\pm 75$ KHz (peak)	
<b>3.1.3</b>	Maximum Frequency Deviation	$\pm 100$ KHz (peak)	
<b>3.1.4</b>	Frequency Setting	Direct from front panel in 10 kHz increments.	
<b>3.1.5</b>	Class of Emission	180KF8E	
<b>3.1.6</b>	Stereo transmissions	Acc. to ITU-R Rec. 450 (Pilot tone)	
<b>3.1.7</b>	Pre-emphasis	0, 50 micro seconds (selectable).	
<b>3.2</b>	<b>RF OUTPUT:</b>		
<b>3.2.1</b>	Rated output power	$\geq 5$ kW	
<b>3.2.2</b>	Rated output(Load)impedance	50 ohm unbalanced.	
<b>3.2.3</b>	Permissible VSWR	1.4: 1 with full power; Power fold-back beyond 1.4: 1; Details of power fold back characteristics to be provided.	
<b>3.2.4</b>	Harmonics suppression and Spurious	Within limits as per Radio Regulations & ITU-R Recommendations. Actual Values to be indicated.	
<b>3.2.5</b>	Overall efficiency	$\geq 60$ %.	
<b>3.2.6</b>	Transmitter RF Power output connector size	3-1/8" with EIA flange	
<b>3.2.7</b>	Max. Frequency tolerance	As per ITU(R)	
<b>3.2.8</b>	Synchronous AM S/N at reference to 100% AM modulation at 400 Hz , 50 micro seconds Pre-emphasis with FM modulation at 75 KHz Deviation	Better than 50 dB	
<b>3.2.9</b>	Asynchronous AM S/N unweighted, referred to 100% AM modulation at 400 Hz, 50 micro seconds Pre-emphasis and without FM modulation.	Better than 55 dB	

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<b>3.3</b>	<b>INPUTS:</b>		
<b>3.3.1</b>	<u>Modulating input signal</u>	Exciter should accept analog mono, analogue stereo (left and right) / encoded stereo signals (MPX), SCA inputs and AES / EBU digital inputs. It should be capable for mono and Stereo Broadcast using pilot tone system conforming to ITU-R, Rec.450	
<b>3.3.2</b>	<u>Input impedance (Analog)</u>	600 ohm or greater, selectable(for mono) 2K ohm or greater selectable(for stereo)	
	<u>Input impedance (Digital)</u>	110 ohm.	
<b>3.3.3</b>	<u>Analog and Digital input level</u> for $\pm 75$ KHz (peak) deviation:	<b>ANALOG AUDIO INPUT:</b> At 1 KHz , 0dB Input Level Adjustable from -6 dBu to + 6 dBu. <b>DIGITAL AUDIO INPUT:</b> At 1 KHz Input Level Adjustable from -20.0 dBFS to 0 dBFS	
<b>3.4</b>	<b>POWER SUPPLY</b>		
<b>3.4.1</b>	Power	three phase as per Section-I	
<b>3.5</b>	<b>MONO OPERATION</b>		
<b>3.5.1</b>	S/N ratio at 75KHz deviation ( 30 Hz to 15 KHz base band ) rms, unweighted	$\geq 70$ dB	
<b>3.5.2</b>	THD + N	Better than 0.15 %.	
<b>3.5.3</b>	IMD SMPTE 60 Hz / 7 KHz , 4:1 , +4dBu	Better than 0.20%.	
<b>3.5.4</b>	Amplitude response 30 Hz to 15 KHz	Better than $\pm 0.5$ dB	
<b>3.6</b>	<b>STEREO OPERATION :</b>		
<b>3.6.1</b>	Stereo separation (sine wave) : 30 Hz to 15 KHz	Better than 50 dB	
<b>3.6.2</b>	Linear Cross Talk referred to 100% modulation: ( 30 Hz to 15 KHz)	Better than 50 dB	
<b>3.6.3</b>	Non-linear Cross Talk referred to 100 % modulation.	Better than 50 dB	
<b>3.6.4</b>	S/N ratio at 75KHz deviation (L or R) ( 30 Hz to 15 KHz Band Width)rms, unweighted	Better than 70 dB	
<b>3.6.5</b>	THD + N(L or R)	Better than 0.15 %.	
<b>3.6.6</b>	IMD SMPTE (L or R) 60 Hz / 7 KHz , 4:1 , +4dBu	Better than 0.20%.	
<b>3.6.7</b>	Amplitude response	Better than $\pm 0.50$ dB	

	(L or R)30 Hz to 15 KHz		
<b>3.6.8</b>	Pilot tone Stability :	As per ITU (R)	
<b>3.7</b>	<b>WIDEBAND COMPOSITE OPERATION:</b>		
<b>3.7.1</b>	FM S/N ratio at 75 KHz deviation rms, unweighted	Better than 70 dB	
<b>3.7.2</b>	THD+N (Total Harmonic Distortion plus Noise)	Better than 0.15 %.	
<b>3.7.3</b>	IMD (SMPTE ) 60 Hz / 7 KHz , 4:1 , +4dBu	Better than 0.20 %.	
<b>3.7.4</b>	Amplitude response 30 Hz to 100 KHz	Better than $\pm$ 0.50 dB	

**3.8 Compatibility of the transmitter for DRM<sup>+</sup>: As per ETSI standards (amended up to date)**

**3.9 REMOTE CONTROL AND TELEMETRY SYSTEM/VSAT/DIALUP CONNECTION: (OPTIONAL)**

**3.9.1 Specifications:**

S.No.	Technical Parameter	Specification	Comments of tenderer with technical details/ data and schematic drawing etc.
<b>1.</b>	Remote control and telemetry/ Controllable Setting / Parameters:	1. Transmitter: ON/OFF 2. Exciter ON/OFF, Audio input, 3. Exciter RF forward and reflected power 4. RF Output Power Level: 5. Program 1/ Program 2 selection 6. DG Set On/Off 7. UPS Status 8. Power supply status of Voltages, currents 9. Alarm Indications: Temperature, VSWR, ON AIR, Audio etc. 10. Any other parameter which the manufacturer considers essential for proper functioning of a remote-controlled FM Station.	
<b>2.</b>	Data Format	To be indicated by tenderer and compatible for above system.	
<b>3.</b>	Data Rate	To be indicated by tenderer and compatible for above data format	
<b>4.</b>	Modem Speed	To be indicated by tenderer and compatible for above data format/rate to be used for a distant/centralized location via ISDN/Digital line/TCP-IP /PSTN	

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		network/Dial up connection telephone lines.	
<b>5.</b>	Computer System	Latest generation, Core 2 Duo processor equivalent or higher, 14" screen, RAM-4 GB, Windows-7 operating system, HDD-320 GB, DVD-RW, 2 USB ports, Card Reader	
<b>6.</b>	Software and hardware items to be given by the renderer	Complete software, hardware items, accessories, single/multi core cables, RF cable connectors, Humidity/temperature transducer, 2/3 Core Shielded Teflon cable , Extension cables etc. (Items wise details of offered and included material, items & part are to be given by the renderer)	

**SECTION IV- (TECHNICAL SPECIFICATION OF OTHER ITEMS AUXILLARY EQUIPMENT AND ACCESSORIES)**

**SECTION IV, A - TECHNICAL SPECIFICATION – 10kW AIR COOLED DUMMY LOAD**

- 4.10 **10 KW Dummy Load, 50 Ohm:** One no. 10 kW air cooled Dummy Load, 50 Ohm with thru line power meter etc. are to be quoted for transmitter as per technical specification given below including power meter , line section, 1-5/8" EIA flanges, for measuring forward ( $\leq 10000\text{ W}$ ) & reflected ( $\leq 1000\text{W}$ ) power including all accessories , cables complete with Adaptor Kit.
- 4.11 **A thru line power meter** - to be used with 10 kW Dummy Load as above for measuring forward & reflected power along with Transducers / Sensing elements are to be quoted as per technical specification given below.

**10 KW DUMMY LOADS**

Sr.No.	Description	Technical Specification
4.12	Power Rating	10 kW continuous
4.13	Connector	1-5/8" EIA Flange
4.14	Frequency Range	88 to 108 MHz
4.15	VSWR	$\leq 1.15:1$
4.16	Impedance(Nominal)	50 Ohm
4.17	Load Coolant	Air cooled
4.18	AC Power	Single Phase as per Section-I
4.19	Dimensions: (Length x Width x Depth)	To be given by the tenderer
4.20	Weight:	To be given by the tenderer

**Thru line RF power meter**

<b>Sr.No.</b>	<b>Description</b>	<b>Technical Specification</b>
4.21	RF Power Meter Rectangular in housing with FORWARD & REFLECTED switch suitable for mounting in 19" rack including measuring elements, elements sockets and line section for connectivity with the rigid lines of size 1-5/8" complete as required. Forward Power: 10.0kW Reflected Power: 1.0kW	1 Set
4.22	Power Rating: Forward Power	10kW continuous
4.23	Power Rating: Reflected Power	1kW
4.24	Frequency Range	88 to 108 MHz
4.25	Impedance	50 Ohm
4.26	AC Power	Single Phase as per Section-I
4.27	Dimensions: (Length x Width x Depth)	To be given by the tenderer
4.28	Weight:	To be given by the tenderer

**SECTION IV, B- TECHNICAL SPECIFICATION MOTORISED RF COAXIAL CHANGE OVER SWITCH**

4.29 Motorized RF co-axial Changeover switch:

3-1/8" including control panel with port & matching flanges for connecting rigid line is to be quoted as per technical specification given below.

The switching will be carried out through above motorized RF Coaxial relay / switch.

<b>Sr.No.</b>	<b>Description</b>	<b>TECHNICAL SPECIFICATION</b>
4.30	<b>Connector</b>	
4.30.1	Input and Out	3-1/8", EIA male
4.30.2	Termination/Dummy Load	1-5/8", EIA male (Through 3-1/8" to 1-5/8" Adaptor for termination/ connection of Dummy Load)
4.31	Frequency Range	88 to 108 MHz
4.32	Impedance	50 Ohm ± 1%

4.33	Power Supply	Single Phase as per Section-I
4.34	Control Voltage	Single Phase as per Section-I
4.35	Isolation	≥ 55 dB
4.36	Average Power Handling Capacity	≥ 10.0 kW
4.37	No. of Ports	4
4.38	Dimensions: (Length x Width x Depth)	To be given by the tenderer
4.39	Weight:	To be given by the tenderer
4.40	Control panel with port & matching flanges for connecting rigid line	Suitable for above Motorized RF co-axial Changeover switch.

**SECTION IV, C-TECHNICAL SPECIFICATION - RF COAXIAL COPPER RIGID LINES &ACCESSORIES**

4.41 Transmitter power will be fed to the Antenna System by an internal 3-1/8" RF co-axial copper rigid line and then an external 3-1/8" air dielectric RF Coaxial cable.

4.42 Following are the Technical Specification of RF co-axial copper Rigid lines (50 Ohm): All accessories are to be offered as per RF co-axial copper Rigid lines details given in SECTION-V (A). RF co-axial copper rigid lines should be of standard make, Technical specification/details are to be supported with printed technical literature/data sheet from the OEM.

SNo.	Technical Parameter	TECHNICAL SPECIFICATION	TECHNICAL SPECIFICATION
4.43	Size	1-5/8"	3-1/8"
4.44	Attenuation (100 MHz) at 24°C	≤ 0.70 dB/100M	≤ 0.35 dB/100M
4.45	Average power rating at ambient temperature 40°C, unity VSWR	≥ 12 kW	≥ 45 kW
4.46	Frequency Range	88-108 MHz	88-108 MHz
4.47	Impedance	50 Ohm	50 Ohm

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

S NO.	Description	Qty
(1)	(2)	(3)
5.1	Supply of 5kW DRM <sup>+</sup> Compatible VHF FM broadcast Solid State MOSFET technology transmitter capable of giving $\geq 5$ kW Continuous power, including two nos. of Exciters; complete as per AIR Specification no: 5kW Digital Compatible VHF FM TX/3/May/ 2010/ -D(TD/FM)	1 Set Complete
5.2	Supply of Complete installation material RF Coaxial copper rigid lines to complete the installation for feeding to the Dummy Load as per specification. [Rates per meter/number shall also be quoted in addition to rates of quantity given in column (3)	
5.2.1	3-1/8" RF coaxial copper Rigid Line with inners, bullets & insulators	12 M
5.2.2	3-1/8" elbows with inners, bullets & insulators	6 numbers
5.2.3	3-1/8" couplings with inners, bullets & insulators	15 numbers
5.2.4	3-1/8" to N Test Reducer	2 number
5.2.5	3-1/8" field flange with inners, bullets & insulators	8 numbers
5.2.6	3-1/8" to 1-5/8" reducer/adopter	2 numbers
5.2.7	1-5/8" to 7/8" reducer /adopter	2 numbers
5.2.8	1- 5/8" rigid line	6 M
5.2.9	1-5/8" elbows with inners, bullets & insulators	6 numbers
5.2.10	1-5/8" couplings with inners, bullets & insulators	15 numbers
5.2.11	1-5/8" to N Test Reducer	2 number
5.2.12	Hanger for 3-1/8" RF coaxial Rigid Line	18 nos.
5.2.13	Hanger for 1-5/8" RF coaxial Rigid Line	6 nos.
5.3	Supply of 10 kW Dummy Load, 50 Ohm , 1-5/8" EIA flanges including thru line power meter for measuring forward & reflected power along with element 10,000 W and 1,000 W including all accessories , complete as per specification.	1 set complete
5.4	Supply of Spare complete set of resistances of Dummy Load for average power rating $\geq 10.0$ kW	1 Set complete
5.5	Supply of Motorized RF co-axial Changeover switch 3-1/8" including control panel with port & matching flanges for connecting rigid line as per specification .	1 Set complete
5.6	Any other item / accessories for equipment/items at SNo. 5.1 to 5.6 offered, for the completeness of the system. Items wise details (including part number, if any) are to be given by the tenderer)	1 Set
5.7	Inspection charges at manufacturer's works of Transmitter as per AIR specification.	1 Lot
5.8	Technical manuals for Installation, testing, commissioning, Operation & Maintenance, including Theory of operation and fault diagnosis printed and duly bound for 5kW DRM <sup>+</sup> Compatible VHF FM transmitter, 10 kW Dummy Load and thru line power meter etc., RF Coaxial copper rigid lines, Motorized RF co-axial Changeover switch, etc as per distribution given below along with one soft copy on CD.	

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5.8.1	For DE (Proj.) P&D Unit, DG:AIR { Within Two Months of Supply order) ( irrespective of number of transmitters to be ordered )	1 set
5.8.2	For <b>Consignee</b> { Within Two Months of Supply order).	2 Sets
5.8.3	For following offices: 14 nos of Technical manuals are to be supplied) {To be supplied along with the equipment}. ( irrespective of number of transmitters to be ordered )	14 sets
	(i) DE (Proj.),P&D Unit, DG:AIR (1 set)	
	(ii) Zonal Office (Project Wing) (5 sets)	
	(iii) Zonal Office (Maintenance Wing) (5 sets)	
	(iv) DE(Transmitter Maintenance), DG:AIR (1 set)	
	(v) Technical Library, P&D Unit, DG:AIR (1 set)	
	(vi) Staff Training Institute (Technical) (1 set)	
	Total (14 sets)	

\* For ranking purpose, actual length / sets will be intimated at the time of placement of order

**SECTION V (B) : SCHEDULE OF REQUIREMENTS / MATERIALS (UNPRICED)  
(OPTIONAL) AND THESE WILL NOT BE CONSIDERED FOR  
RANKING PURPOSE)**

**{The tenderer must quote all items}**

**FOR ONE SET OF TRANSMITTER & ASSOCIATED EQUIPMENT)**

<b>S NO.</b>	<b>Description</b>	<b>Qty</b>
5.10	Training Charges at one AIR site for AIR engineers (10 persons) for transmitter for 3 working days.	1 number
5.11	List of recommended spares and any other accessories. (Items wise details of offered material/ items & part are to be given by the tenderer). In case of kits, full item wise details of kits are to be provided. Tenderer shall quote the rate / cost of individual items/unit/spares in the tender offer while submitting the offer for spares.	
5.11.1	Recommended Spares based on failure pattern for one set of transmitter: These shall include: i. IPA, PA MOSFET / Sub Modules. ii. PCB's / Interface Cards/modules. iii. Kit for spares comprising of Low power semi conductor devices/ MOV/ Tunnel Diodes, IC's/ L.S.I, PCB's/ Interface Cards/modules, Switches/Opto couplers/Transducers &Meters/Displays etc. iv. Spare Modules IPA and PA. v. Sub assemblies/Changeover Units. vi. Spare power supply unit. vii. Complete control unit/Microprocessor Controller. viii. One set of filter. ix. Blower with motor. x. Other miscellaneous items including power combiner, its sub-systems, harmonic filter, absorbers, etc.	1 Set complete

ANNEXURE-I

INSPECTION DETAILS

The inspection for acceptance of the Transmitter equipment on dummy load will be carried out at the Works of the Manufacturer 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. Complete details and specifications of the Transmitter will be checked and all parameter values will be measured.

Transmitter's equipment spares as per Order will be tested in circuit on dummy load at Manufacturer's Works by Engineer(s) of Indenter.

The tenderer shall put up all the Transmitter System for Inspection in lot out of which 10% randomly selected transmitter system shall be inspected on dummy load in details and measurements shall be taken.

Complete details and specifications of the Transmitter System will be checked and all parameter values will be measured. All the 10 % randomly selected transmitters shall be tested for heat run for continuously 24 hours on dummy load.

All other equipment will be accepted on the basis of Original Equipment Manufacture's (OEM) Test Certificates (as per AIR Specification) duly signed and stamped on the letter head of the OEM, failing which Original Equipment Manufacture's (OEM) Test Certificates will be considered incomplete and equipment offered by the firm is liable to be rejected.

**However, operational & functional checking of all the Transmitters shall be carried out at three different frequencies in the VHF band 88 to 108 MHz as per mutually agreed ATP.**

The associated /auxiliary Equipment & accessories i.e. equipment/items at SECTION V (A) S NO. 5.2, 5.5, 5.6 & SECTION V (B) (Applicable, in case, part of Order) S NO. 5.11 will be accepted on the basis of Original equipment manufacturers test certificate (OEM's) and received at site by ultimate consignee, in good condition.

The complete Acceptance Test Procedure/Protocol (ATP) will be prepared by the manufacturer and submitted to Director Engineering (Proj.), P&D Unit, DG: AIR for approval. This Procedure after modification (if required during the process of approval) shall form the basis for Performance / Inspection Tests to be carried out. ATP will also indicate full details of set up for measuring / testing equipment to be deployed during the Performance Measurement/ Inspection Test at factory.

Testing and measurements of the Transmitter will be carried out at the work of the manufacture on three phase, 4-wire, 400 Volt (rms)  $\pm 10\%$ , 50 Hz  $\pm 4\%$  power supply available at the Transmitter's input circuit breaker without any outside transformer unit etc. at any three frequencies in the VHF band, 88 to 108 MHz without change of components/ settings tuning. No other voltage will be acceptable to AIR at the Transmitter's input circuit breaker and failing which the transmitter equipment is liable to be rejected.

The technical facilities/ equipment for varying within  $\pm 10\%$  of three phase, 4-wire, 400Volts (rms) should be available at manufacturer's works for Testing, measurements and operation 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.

Complete set of instruments will be made available in advance and the list of these measuring

instruments along with their set ups may be forwarded along with the Tender.

Tenderer shall arrange for the photographs of inside of Transmitter's cubicle which will be attached with the ATP/Inspection report.

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.

It is mandatory that all these testing and measurements i.e. Operation checking of the Transmitter and measurements as per parameters in Section III at any three frequencies in the VHF band, 88 to 108 MHz without change of components/ settings tuning, are carried out well in advance. These must also be submitted to Indenter along with the call for inspection of Transmitter well in advance for analyzing etc.

These measurements details, graphical printout notes and figures must be available, at the factory at the time of inspection.

Following information should also form part of above data which will also be checked for each Tx during inspection by indenter's representative **at Transmitter manufacturer's works:-**

- A-1.0 Origin of Country, Make, type, model number & name of all units of Transmitter, other items & the accessories, and spares.
- A-2.0 Dimension of Transmitter rack, Sub-Units and Accessories, other items & the accessories.
- A-3.0 Working/operation of all Sub-Units and Accessories.
- A-4.0 System configuration check and completeness of Transmitter.
- A-5.0 Automatic changeover of Exciter and IPA (if applicable) etc.
- A-6.0 Checking meter readings and calibration.
- A-7.0 Measurements of all parameters as per specification. All the parameters will be measured on any 3 different frequencies in VHF FM band (88MHz to 108MHz).
- A-8.0 Checking of control and protection system of Transmitter.
- A-9.0 Checking of all power levels, meters, LEDs etc.
- A-10.0 Checking of RF voltages on test points.
- A-11.0 Inter-changeability of PAs, sub-modules.
- A-12.0 Exciter operation, checking and measurements.
- A-13.0 Working of Exciter in all mode as per Specification including Modulating inputs as per specification :
- A-14.0 Measurement of levels in the whole AF and RF chain.
- A-15.0 Checking of all spares, PCB's, modules for the respective transmitter, other items & the accessories.

**Annexure-II**

LIST OF 5kW DRM<sup>+</sup> Compatible VHF FM TRANSMITTER PLACES

<b>SNo.</b>	<b>PLACE</b>
<b>(1)</b>	<b>(2)</b>
1	Bhuj
2	Ambikapur
3	Chhatarpur
4	Gwalior
5	Jalgaon
6	Tura
7	Bhawanipatna
8	Sambalpur
9	Ajmer
10	Almora
11	Agra
12	Kurseong