



All India Radio



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

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INTRODUCTION: This Specification is for supply of 20 kW VHF FM Solid State Broadcast Transmitter using MOSFET technology and associated auxiliary equipment for AIR.

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1. Each clause of this specification has to be complied with & supported by printed matter from the manufacturer of the equipment by the Tenderer, without which tender will be considered incomplete and will liable to be rejected. The Tenderer should make a detailed offer while quoting for the Transmitter, auxiliary equipment and accessories.
2. This Specification comprises of 26 pages.

SECTION- I GENERAL

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

- 1.0 20 kW MOSFET based technology VHF FM Transmitter shall be capable of continuous round the clock operation having two numbers of Exciters complete as per AIR Specification including all equipment/items under Section -IV.
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 Factory Test and Inspection : at Manufacturer's Works.
- 1.2 A set of recommended spares : As per section V(B) (**OPTIONAL**)
- 1.3 TRAINING: At AIR Site: As per section V(B) (**OPTIONAL**)
- 1.4 **The following are excluded from the scope & will be provided by AIR:**
 - 1.4.1 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.
 - 1.4.2 Electric supply connection for the transmitting equipment, at a single point.
 - 1.4.3 Tower for mounting Antennae
 - 1.4.4 Furniture & fittings not forming a part of the transmitter equipment.
 - 1.4.5 Installation of equipment at site.
 - 1.4.6 Commissioning of Transmitters at site.
- 1.5 **Tender documents (instructions to bidders) shall be referred for general term and conditions of contract for supply including all the commercial aspects**
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's liability for Damages, Defects, Recovery of Compensation, Ensuring Payment and Amenities, 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** (except para 8.2.2).

1.6 LANGUAGE / UNITS:

All information supplied by the Tenderer & all markings, notes, designation on the drawings & associated write-ups shall be in "**English language**" only.

All dimensions, units on drawings, all references to weights , measures , quantities shall be in metric units.

1.7 INFORMATION TO BE SUPPLIED WITH THE TENDER IN DUPLICATE :

1.7.1 A **Compliance Statement** to the Complete specification of AIR, para wise, for each clause .

1.7.2 Complete **printed information** in support of compliance statement should be furnished for all the items of the tender to assess the full merit of the offer.

1.7.3 Detailed Schedule of Materials offered for Transmitter,Auxiliary Equipment & accessories for each transmitter shall be in conformity with SECTION -V (A & B) with out any change in format. **The tenderer must quote all items of Section -V (A & B).**

1.7.4 Make, type, model number, country of origin in respect of all items shall be submitted along with the name & address of their vendors.

1.7.5 Layout plan and full construction details of Transmitter cubicles and external units including dimensions, weights, overall sizes & photographs/ illustrations of the interior of the Transmitter cubicles should be in CD form also.

1.7.6 Transmitter Block diagram/ Schematic drawings indicating the details of Redundancy incorporated in Transmitter Configuration and its subsystems.

1.7.7 Exciter Schematic, detailed drawing showing all the inputs as per the specification and the auto change over facility for inputs.

1.7.8 Control system Schematic.

1.7.9 Cooling system Schematic.

1.7.10 Transmitter interlocks Schematic drawing including external units and accessories like dummy load, changeover switches, reject loads, exhaust fan etc. which should be wired in Transmitter interlocks.

1.7.11 Power amplifier Schematic, IPA Schematic drawings.

1.7.12 Splitter, Combiner detailed schematic drawings .

1.7.13 Details schematic drawings of remote control and telemetry system.

1.7.14 Details of ventilation and Air- conditioning requirements for main Transmitter and its accessories.

1.7.15 Technical data sheet of all high power semiconductor devices used in the equipment.

1.7.16 Details of MTBF (Mean Time Between Failure) & MTTR(Mean time to repairs) to be provided in respect of power semi conductor devices.

1.7.17 Details of failure modes of individual devices and components based upon field feed back reports.

1.7.18 A supply record of 20 KW VHF FM transmitters power wise and year wise in the last 5 years shall be enclosed by the tenderer.

1.7.19 A complete set of performance figures of similar Transmitter, auxiliary equipment and accessories (duly certified by the customers) must be furnished along with the tender.

1.8 INFORMATION TO BE SUPPLIED BY THE TENDERER AFTER

AWARD OF SUPPLY ORDER :

One printed & duly bound set of Installation, Commissioning, Operation & Maintenance (including theory of operation and fault diagnosis) technical manuals for main Transmitter, Auxiliary Equipment & accessories shall be supplied to the Director Engineering (Project), P&D Unit, DG: AIR New Delhi within two months of Acceptance of Tender. (irrespective of number of transmitters ordered). All the details should be complete and exhaustive. One Soft copy of these documents is also required on CD.

1.9 INFORMATION TO PRECEDE DESPATCH OF EQUIPMENT:

Following information should be supplied to the DE (Proj) P&D Unit, DG: AIR New Delhi, prior to dispatch of Equipment :

1.9.1 Detailed list of Equipments under dispatch.

1.9.2 Photograph with illustrations showing location of components in the various units and sub-units with item numbers marked there-on (i.e. on component as well at its location).

1.10 INFORMATION TO BE SUPPLIED ALONG WITH EQUIPMENT:

1.10.1 For each Transmitter, Auxiliary Equipment & accessories **two** printed & duly bound copies of technical manuals as per clause 1.8 as above along with duly filled ATP and soft copy are to be supplied to each consignee.

1.10.2 Six sets of these documents as per clause 1.8 as above are required to be sent (irrespective of number of transmitters ordered) to the officers / offices / places as per SECTION - V(A):

1.11 DELIVERY OF EQUIPMENT:

Within **six** months from date of placing of order .

1.12 GUARANTEE:

Tenderer shall submit an undertaking to make good within 30 days at his own expense any component in respect of all equipment as per AIR specification which becomes defective under normal operating conditions within 18 months from the date of receipt of the equipment at respective site or 12 months from the date of commissioning at site, whichever is later.

1.13 INSPECTION:

Detailed inspection of Transmitter, Auxiliary Equipment & accessories will be carried out at Manufacturers Works by Engineer(s) of All India Radio as per detail given in Annexure-I. The manufacturer shall put up all the Transmitter, Auxiliary Equipment & accessories for test on the Test Bench at his premises before the AIR representatives and shall provide electric energy, consumable materials, tools, testing instruments, labour and assistance of every kind for carrying out the acceptance tests & preparation of Inspection Test Report. Complete specifications & details will be checked and all parameter values will be measured.

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.

1.14 TRAINING: At AIR Site (OPTIONAL).

The tenderer shall train 12 AIR engineers for 5 working days **at one** AIR Site 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.

1.15 ISO CERTIFICATION: The tenderer should either be Original Equipment Manufacturer or supply the equipment only from the OEM. OEM should have valid ISO Certification for the manufacturing work and the documentary proof for the same shall be enclosed by the tender with the tender paper/documents.

SECTION II

TECHNICAL DESCRIPTION OF TRANSMITTER

2.0 TRANSMITTER CONFIGURATION:

- 2.1 20 KW solid state MOSFET technology FM Transmitter without tuning (frequency agile) shall be capable of giving ≥ 20 kW power continuously. It should consist of a number of low power hot pluggable modular power amplifiers.

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 change over of exciter should also take place when power of active exciter goes down by ≥ 3 dB.

- 2.2 The Transmitter will be complete in all respects. Indenter will provide power supply of three phase, 4 wire, 400 Volt (rms) $\pm 10\%$, 50 Hz $\pm 4\%$ 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. The performance of transmitter as per parameters in Section-III should be ensured without degradation with the given power supply tolerances.

- 2.3 A set of RF, DC, power supply and control cables with appropriate connectors , extender cables and extender cards are to be supplied for testing the PA unit / IPA unit and exciter unit etc. outside the Transmitter rack . Details of above are to be enclosed.(Optional)
- 2.4 The Transmitter shall be suitable for unattended round-the-clock operation with 1:2 redundancy for any stage/module in the RF chain between exciter and PA stages . (if applicable)
- 2.5 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.
- 2.6 All stages i.e. Exciter, IPA, PAs, Combiner, harmonic filters, etc. shall be capable of operation in the entire VHF frequency band, 88 to 108 MHz **with out** change of components.
- 2.7 The Transmitter shall be suitable for Mono and Stereo FM Radio Broadcast.
- 2.8 Transmitter should be of modular design for easy maintenance & part replacement.
- 2.9 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.

- 2.10 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.
- 2.11 The Transmitter must have Auto Ramp Up circuit for power rise when Transmitter is "Switched-On". It should be possible to vary the Transmitter power from at least 2 kW to full value from front panel control on controller. Details to be provided by tenderer.
- 2.12 **Exciter:-**
- 2.12.1 Exciter 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 .
- 2.12.2 It should have its own manually adjustable power control. The pre-emphasis should be Selectable / Switchable.
- 2.12.3 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.
- 2.12.4 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 output tuning over its entire specified operating frequency range.
- 2.13 **Intermediate Power Amplifier Modules:**(If Intermediate Power Amplifiers are provided as per design of manufactures): 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 may 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.
- 2.14 **Power Amplifier Modules:** Total transmitter output power will be developed by an optimum combination of low power PA Modules and should be capable of operation in the entire VHF frequency band, 88 to 108 MHz **without tuning** .

Each of the PA will 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", "over-temperature", "over-drive" and "air-flow" failure.
The efficiency figures for each PA are to be indicated.

2.15 Combiner Unit: The final power combiner preceding 20 kW RF power stage shall be of such type so as to be capable to operate in entire 88-108 MHz without any tuning & change of components.

Tenderer shall offer 20 KW VHF FM transmitter either in a single Unit or a combination of 2 numbers of 10 kW VHF FM transmitters. No other combination shall be acceptable to AIR.

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

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

2.16 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 technical details along with **schematic diagrams** should be enclosed in the tender.

2.17 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:

- 2.17.1 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.
- 2.17.2 Protection against over temperature on heat sinks.
- 2.17.3 Protection against blower failure and less volume of cooling air.
- 2.17.4 Protection against higher VSWR including open and short conditions at output.
- 2.17.5 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 foldback to be provided.

2.17.6 External units and accessories like Dummy Load, Change over switches etc. should be wired in Transmitter interlock.

2.17.7 Transmitter should be protected against lightning by providing DC / RF discharge path and details be given in the tender.

2.18 Control and Interlocking:

2.18.1 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.

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

2.18.3 It shall be possible to switch off the entire Transmitter in emergency with the operation of a **single push button/ manual command** to be provided on front panel.

2.18.4 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 2.17 shall remain indicated until reset. The fault indication shall be supplemented with audible alarm.

2.19 INSTRUMENTATION & INDICATIONS :

All important parameters required for monitoring and fault diagnosis will 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.

2.19.1 Transmitter status and fault conditions shall be indicated by colour coded Display on a mimic diagram - Numbers of LED's or Display for "**status indication**" and "**fault indication**" to be indicated in tender.

2.19.2 Suitable test points for operational check out side the module on front panel shall also be provided.

2.19.3 RF Sampled outputs (Forward and Reverse) should be provided on connectors for performance measurement.

2.20 COOLING SYSTEM:

Full details of cooling system and blowers shall be given. Temperature rise of cooling air/water for rated power output is to be indicated. Details of cooling system shall be given.

2.21 TRANSMITTER POWER SUPPLY:

Transmitter should have its own input circuit breaker for the mains supply. The transmitter's inbuilt power supply system should be able to take care of specified variations in the main supply i.e. Tr. should comply with three phase, 4 wire, 400 Volt (rms) $\pm 10\%$, 50 Hz $\pm 4\%$

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.

<p>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.</p> <p>2.22 SPARES (OPTIONAL): The tenderer shall quote for one set of spares as per section V(B).</p>

2.23	REMOTE CONTROL AND TELEMETRY (OPTIONAL)
2.23.1	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.
2.23.2	The transmitter should be capable of operation with general purpose PCs with Modems. Users can 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.
2.23.3	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. The ports for Remote PC and local PC should be separate so that both can operate simultaneously.
2.23.4	Details of control parameters & indications/metering shall be given.

SECTION-III TECHNICAL SPECIFICATIONS OF TRANSMITTER

SNo.	TECHNICAL PARAMETER	TECHNICAL SPECIFICATION	COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos
3.1	GENERAL		
3.1.1	Frequency Range	: 88 to 108 MHz.	
3.1.2	Class of Emission	: 180 KF8E.	
3.1.3	Stereo transmissions	: Acc. to ITU-R Rec. 450 (Pilot tone).	
3.1.4	Nominal Frequency deviation	: ± 75 KHz (peak)	
3.1.5	Maximum Frequency Deviation	: up to ± 100 KHz (peak)	
3.1.6	Pre-emphasis	: 0, 50 and 75 micro seconds (selectable).	
3.2	RF OUTPUT:		
3.2.1	Rated output power	: ≥ 20 kW	
3.2.2	Rated output(Load)impedance	: 50 ohm unbalanced.	
3.2.3	Permissible VSWR	: 1.4: 1 with full power; Power fold-back beyond 1.4: 1 ; Details of power fold back characteristics to be provided.	
3.2.4	Harmonics suppression and Spurious	: Within limits as per Radio Regulations & ITU-R Recommendations. Actual values to be indicated.	
3.2.5	Overall efficiency	: ≥ 60 %.	
3.2.6	Transmitter RF Power output connector size	: 3-1/8"with EIA flange	
3.2.7	Max. Frequency tolerance	: ± 300 Hz , as per ITU (R)	
3.2.8	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	
3.2.9	Asynchronous AM S/N <i>unweighted</i> , referred to 100% AM modulation at 400 Hz , 50 micro seconds Pre-emphasis and without	: Better than 55 dB	

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	FM modulation.		
3.3	INPUTS:		
3.3.1	<u>Modulating input signal</u>	:Exciter should accept analog mono, analogue stereo (left and right) / encoded stereo signals (MPX), DARC, SCA inputs and AES / EBU digital inputs. It should be capable for mono and Stereo Broadcasting using pilot tone system conforming to ITU-R, Rec.450.	
3.3.2	<u>Input impedance (Analog)</u>	600 ohm and 10K ohm or greater, selectable	
	<u>Input impedance (Digital)</u>	110 ohm .	
3.3.3	<u>Analog and Digital input level for ± 75 KHz (peak) deviation:</u>	ANALOG AUDIO INPUT: At 1 KHz , 0 dBu : Input Level Adjustable from -6 dBu to +12 dBu . DIGITAL AUDIO INPUT: At 1 KHz : Input Level Adjustable from -20.0 to 0.0 dBFS .	
3.4	POWER SUPPLY		
3.4.1	<u>Power</u>	: three phase, 4 wire, 400 Volt (rms) $\pm 10\%$, 50 Hz $\pm 4\%$	
3.4.2	<u>Power factor</u>	: better than 0.9	
3.5	MONO OPERATION		
3.5.1	S/N ratio at 75 KHz deviation (30 Hz to 15 KHz base band) rms, unweighted	: Better than 75 dB	
3.5.2	THD + N	: Better than 0.1 %.	
3.5.3	IMD SMPTE	: Better than 0.1 %.	
3.5.4	Amplitude response 30 Hz to 15 KHz	: Better than ± 0.3 dB	
3.6	STEREO OPERATION :		
3.6.1	Stereo separation (sine wave) : 30 Hz to 15 KHz	:Better than 50 dB	
3.6.2	Dynamic stereo separation : (30 Hz to 15 KHz)	:Better than 45 dB	
3.6.3	Linear Cross Talk referred to 100% modulation: (30 Hz to 15 KHz)	: Better than 50 dB	

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3.6.4	Non-linear Cross Talk referred to 100 % modulation.	: Better than 60 dB	
3.6.5	S/N ratio at 75 KHz deviation (L or R) (30 Hz to 15 KHz Band Width) rms, unweighted	: Better than 70 dB	
3.6.6	THD + N(L or R)	: Better than 0.1 %.	
3.6.7	IMD SMPTE (L or R)	: Better than 0.1 %.	
3.6.8	Amplitude response (L or R)30 Hz to 15 KHz	: Better than ± 0.3 dB	
3.6.9	Pilot tone Stability :	: As per ITU(R)	
3.7	WIDEBAND COMPOSITE OPERATION:		
3.7.1	FM S/N ratio at 75 KHz deviation rms, unweighted	: Better than 70 dB	
3.7.2	THD+N (Total Harmonic Distortion plus Noise)	: Better than 0.1 %.	
3.7.3	IMD (SMPTE)	: Better than 0.1 %.	
3.7.4	Amplitude response 30 Hz to 100 KHz	: Better than ± 0.3 dB	
3.8	ENVIRONMENT CONDITIONS :		
3.8.1	Ambient temperature range for operation	: 0° C to + 50° C	
3.8.2	Relative humidity	: 95 percent, non condensing.	
3.8.3	Working altitude	: Up to 3000 meters AMSL	

REMOTE CONTROL AND TELEMETRY : (OPTIONAL)

SNo.	Technical Parameter	Specification	Comments of tenderer with technical details/data and schematic drawing etc.
3.9	Remote control and telemetry Controllable Setting	1. Transmitter: ON/OFF 2. Exciter ON/OFF, Power Level, Audio input, Pre-emphasis (0/50/75), Stereo: ON/OFF;	

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	/ Parameters:	<ul style="list-style-type: none"> 3. Power Amplifier (PA): RF Output Power Level: ON/OFF 4. Air Conditioning and Diesel Generator ON/OFF 5. Program 1/ Program 2 selection 6. Auto change over of Exciter 1 and 2 	
3.9.1	Remote control and telemetry Monitorable Parameters:	<ul style="list-style-type: none"> 1. Exciter RF forward and reflected power 2. Exciter Audio Level (L/R) 3. P.A.'s VSWR, Voltage and Current, Temperature and over drive alarms (Over Current, Over Voltage) 4. Individual Unit faults and indications 5. Alarm Indications: Temperature, VSWR, ON AIR, Audio etc. 6. Co-axial Switch Position 7. Power supply status of Voltages, currents, power factor 8. Status of AC Units 9. Temperature, humidity etc. 10. Any other parameter which the manufacturer things essential for proper functioning of a remote-controlled FM Station 	
3.9.2	Data Format	To be indicated and compatible for above system.	
3.93	Data Rate	to be indicated and compatible for above data format	
3.9.4	Modem Speed	to be indicated and compatible for above data format / rate to be used for a distant/centralized location via ISDN/Digital line/TCP-IP /PSTN network	

SECTION IV,A-Technical Specification FM Mono and Stereo Modulation Monitor including RF amplifier:

4.1 One Set. of FM Mono and Stereo Mod Monitor to be used in – tandem with RF amplifier are to be quoted as per technical specification given below. FM modulation monitor;
 (i) should provide standard deviation reference and zero deviation for SNR .
 (ii) should provide MPX signal output.

FM Mono and Stereo Modulation Monitor including RF amplifier:

SNo.	Parameter	Technical Specification	COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos
4.2	R.F. INPUT:		
4.2.1	Frequency range	88-108 MHz [To be Tunable to any frequency in VHF FM band 88 MHz to 108 MHz] in steps of 100 KHz.	
4.2.2	Maximum (High level) RF Input	10 Vrms, 50 Ohm BNC	
4.2.3	Nominal Input level	3.5 V p-p, 50 Ohms on BNC.	
4.2.4	AGC range	60 db.	
4.2.5	Sensitivity	100 mv or better.	
4.2.6	Accuracy at all modulation levels	± 2%	
4.3	BASEBAND MEASUREMENTS:		
4.3.1	Modulation frequency	30 Hz - 100 KHz	
4.3.2	Frequency deviation	± 75 KHz for 100% modulation.	
4.3.3	Frequency deviation indication	0 to 133%	
4.3.4	Frequency deviation indication accuracy	± 2%	
4.3.5	AM noise measurement	To measure AM noise down to 70 db from 100% AM modulation.	
4.3.6	<u>MPX signal output :</u>		
4.3.6(i)	Frequency response (30 Hz to 100 KHz)	Better than 0.25 db	
4.3.6(ii)	Harmonic Distortion	Better than 0.01%	
4.3.6(iii)	IMD (SMPTE)	Better than 0.01%	
4.3.6(iv)	SNR	Better than 90 db	

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4.4	STEREO MEASUREMENTS:		
	It should have 2 semi peak modulation meters for simultaneous monitoring of L & R channels, total modulation and measurements of channel separation, cross talk, S.C. suppression, noise and pilot etc. It should be possible to feed in MPX signal separately.		
4.4.1	Channel separation (L/R or R/L)	Better than 65 db, 30 Hz to 15 KHz	
4.4.2	Cross talk (L+R) to (L-R) or (L-R) to (L+R)	Better than 65 db, 30 Hz to 15 KHz with full range reading as 0 to 90 db.	
4.4.3	Pilot carrier measurement	0.5%, from 7% to 13% injection	
4.4.4	Range indication	0-60 db, auto in 10 db steps	

4.5	OUTPUT:		
4.5.1	Level (L & R)	+ 5 dbm, 600 ohms, balanced	
4.5.2	Frequency response	\pm 0.25 db, 30 Hz to 15 KHz	
4.5.3	De-emphasis	50 u sec.	
4.5.4	Signal to noise ratio	80 db	
4.5.5	Harmonic distortion	0.01%	
4.5.6	Inter-modulation distortion (SMPTE)	0.01%	
4.6	POWER REQUIREMENTS		
4.6.1	Input power	Single Phase ,230 V(rms) \pm 10%, 50 Hz \pm 4%	

4.7	GENERAL REQUIREMENTS:		
4.7.1	All RF input and power input cords with suitable connectors are to be provided.		
4.7.2	Instrument should be able to be mounted in a standard 19" rack.		
4.7.3	All accessories needed for various measurements to be quoted.		

SECTION IV, B - TECHNICAL SPECIFICATION - 25 kW AIR COOLED DUMMY LOAD

- 4.8 **25 KW Dummy Load, 50 Ohm:** One no. 25 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, 3-1/8" EIA flanges, for measuring forward (≤ 25 kW) & reflected (≤ 2.5 kW) power including all accessories , cables complete with Adaptor Kit.
- 4.9 **A thru line power meter** - to be used with 25 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 .

25 KW DUMMY LOAD

S.No.	Description	Technical Specification	COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos
4.10	Power Rating	25 kW continuous	
4.11	Connector	3-1/8" EIA Flange	
4.12	Frequency Range	88 to 108 MHz	
4.13	VSWR	$\leq 1.15:1$	
4.14	Impedance(Nominal)	50 Ohm	
4.15	Load Coolant	Air cooled	
4.16	AC Power	Single Phase, 230 volts(rms) $\pm 10\%$, 50 Hz $\pm 4\%$	
4.17	Dimensions: (Length x Width x Depth)	To be given by the tenderer	
4.18	Weight:	To be given by the tenderer	

Thru line RF power meter

S.No.	Description	Technical Specification	COMMENTS OF TENDERER WITH TECHNICAL DATA/ SCHEMATIC DRAWINGS Nos
4.19	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 3-1/8" complete as required. Forward Power : 25.0 kW Reflected Power: 2.5 kW	1 Set	
4.20	Power Rating: Forward Power	25 kW continuous	
4.21	Power Rating: Reflected Power	2.5 kW	
4.22	Frequency Range	88 to 108 MHz	
4.23	VSWR	≤ 1.1:1	
4.24	Impedance	50 Ohm	
4.25	AC Power	Single Phase, 230 volts (rms) ± 10%, 50 Hz ± 4%	
4.26	Dimensions: (Length x Width x Depth)	To be given by the tenderer	
4.27	Weight:	To be given by the tenderer	

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

4.28	Motorized RF co-axial Changeover switch , Single Phase, 230 volts (rms) ± 10%, 50 Hz ± 4%, 3-1/8" including control panel with port & matching flanges for connecting rigid line are to be quoted as per technical specification given below. The switching will be carried out through above motorized RF coaxial relay / switch.
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S.No.	Description	TECHNICAL SPECIFICATION	COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos
4.29	Connector		
4.29.1	Input and Out	3-1/8", EIA male	
4.29.2	Termination/Dummy Load	3-1/8", EIA male	
4.30	Frequency Range	88 to 108 MHz	
4.31	Impedance	50 ohm	

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4.32	VSWR	$\leq 1.1:1$	
4.33	Power Supply	Single Phase, 230 volts(rms) $\pm 10\%$, 50 Hz $\pm 4\%$	
4.34	Control Voltage	Single Phase, 230 volts(rms) $\pm 10\%$, 50 Hz $\pm 4\%$	
4.35	Isolation	≥ 55 dB	
4.36	Average Power Handling Capacity	≥ 25.0 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, D-TECHNICAL SPECIFICATION - RF COAXIAL RIGID LINES

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

4.42 Following are the Technical Specification of RF co-axial Rigid lines (50 Ohm): All accessories associated with are to be Offered as per RF co-axial Rigid lines details given in SECTION-V(A).

SNo.	Technical Parameter	TECHNICAL SPECIFICATION	COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos
4.43	Size	3-1/8"	
4.44	VSWR	$\leq 1.1:1.0$	
4.45	Attenuation (100 MHz) at 20°C	≤ 0.35 dB/100M	
4.46	Average power handling capacity at ambient temperature 40°C	≥ 45 kW	
4.47	Frequency Range	88-108 MHz	
4.48	Impedance	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	20 kW VHF FM Solid State Broadcast transmitter using MOSFET technology capable of giving ≥ 20 kW Continuous power, including two nos. of Exciters; complete as per AIR Specification no: 20 kW FM TX/1/May/ 2007/ -D(TD/FM)	* 1 Set Complete
5.2	Complete installation material RF Coaxial rigid lines as given below for each transmitter such as rigid lines, elbows, unions & matching reducers, wherever necessary to complete the installation for feeding to the Antenna & Dummy Load as per specification in Section -IV [Rates per meter/number shall also be quoted in addition to rates of quantity given in column (3)]	
5.2.1	3-1/8" rigid line	18 M.
5.2.2	3-1/8" elbows with inner & bullets	14 nos.
5.2.3	3-1/8" couplings with inner & bullets	24 nos.
5.2.4	3-1/8" to N Test Reducer	2 nos.
5.2.5	3-1/8" field flange with inner & bullets	4 nos.
5.2.6	3-1/8" to 4-1/2" reducer /adopter	2 nos
5.2.7	3-1/8" to 1-5/8" reducer /adopter	2 nos.
5.3	25 KW Dummy Load, 50 Ohm ,3-1/8" EIA flanges including thru line power meter for measuring forward (≤ 25 kW) & reflected (≤ 2.5 kW) power including all accessories , cables complete with Adaptor Kit as per specification in SECTION -IV.	1 set complete
5.3.1	Spare resistance of Dummy Load for measuring forward (≤ 25 kW) power including all accessories.	1 No.
5.3.2	Ducting accessories for exhaust & intake of Dummy Load	1Set
5.4	Motorized RF co-axial Changeover switch 3-1/8" including control panel with port & matching flanges for connecting rigid line similar as per specification in Section IV.	1 Set complete
5.5	FM Stereo Mod Monitor to be used in – tandem with RF amplifier as per specification .	1 Set complete
5.6	Any other item / accessories for equipment/items at SNo. 5.1 to 5.5 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, Auxiliary Equipment & Accessories as per AIR specification.	1 Lot.

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5.8	Technical manuals for Installation, commissioning , Operation & Maintenance, including Theory of operation and fault diagnosis printed and duly bound for 20 KW VHF FM transmitter, 25 kW Dummy Load and thru line power meter etc., RF Coaxial rigid lines, Motorized RF co-axial Changeover switch ,FM Stereo Mod Monitor as per distribution given below with RF amplifier etc. - along with one soft copy on CD.	
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 Consignee { Within Two Months of Supply order).	2 Sets
5.8.3	The following officers: following 6 nos of Technical manuals are to be supplied) { To be supplied along with the equipment }. (irrespective of number of transmitters to be ordered)	6 sets
	(i) DE (Proj.),P&D Unit, DG:AIR - 1 set	
	(ii) Zonal Office (Project Wing) - 1 set	
	(iii) Zonal Office (Maintenance Wing) - 1 set	
	(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 - 6 sets	
	One Soft copy on CD for DE(Proj), P & D Unit, DG AIR	

* As per list of 20 kW VHF FM transmitter ---- places

SECTION V(B) : (OPTIONAL)

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)

S NO.	Description	Qty
5.9	Training Charges at one AIR site for AIR engineers (12 persons) for transmitter for 5 working days.	1 number
5.10	A set of RF, DC power supply cables and control cables with appropriate connectors , extender cables and extender cards etc.	1 Set Complete
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.	

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	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 for One set of transmitter : These shall include: (i) IPA, PA MOSFET / Sub Modules (ii) Low power semi conductor devices / MOV/ Tunnel Diodes etc. (iii) IC's / L.S.I. (iv) PCB's / Interface Cards/modules (v) Switches / Opto couplers/Transducers (vi) Meters / Displays (vii) Discrete items like resistances, capacitors & inductance (vii) Spare Modules IPA and PA. (viii) Sub assemblies/Changeover Units (ix) Spare resistance for Dummy Load. (x) Spare power supply unit (xi) Complete control unit/Microprocessor Controller (xii) One set of filter (xiii) Blower with motor (xiv) Other miscellaneous items including power combiner, its sub-systems, harmonic filter, absorbers, etc.	1 Set complete
5.11.2	Recommended Spares for 25 kW Dummy Load and thru line power meter etc.	1 Set complete
5.11.3	Spare element for thru line power meter for measuring forward (≤ 25 kW) power including all accessories	1 number
5.11.4	Spare element for thru line power meter for measuring reflected (≤ 2.5 kW) power including all accessories	1 number
5.11.5	Recommended Spares for RF Coaxial rigid lines	1 Set complete
5.11.6	Recommended Spares for Motorised RF Coaxial change over Switch	1 Set complete
5.11.7	Recommended Spares for FM Stereo Mod Monitor to be used in – tandem with RF amplifier as per specification .	1 Set complete
5.12	Remote Control & Telemetry Equipment for a distant/centralized location via ISDN/Digital lines/TCP-IP / PSTN network as per Section -II and Section-III	
5.12.1	General Purpose PC suitable for Remote Control & Telemetry Equipment complete as required	2 Sets
5.12.2	Remote Control System complete as required	1 Set
5.12.3	Wiring Interface Unit	1 Set
5.12.4	Dial line Suppressor	1Set
5.12.5	External Modems	2 Sets
5.12.6	Complete software, hardware items, accessories, single/multi core cables, 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 tenderer)	1 Set
5.12.7	Any other accessories offered for the completeness of the system (Items wise details of offered and included material , items & part are to be given by the tenderer)	1 lot

ANNEXURE-I : GUIDELINES / INSPECTION DETAILS

The inspection for acceptance of the Transmitter, Auxiliary Equipment & accessories 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 supplier. Complete details and specifications of the Transmitter, Auxiliary Equipment & accessories will be checked and all parameter values will be measured.

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, Auxiliary Equipment & accessories will be carried out at above 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 with out tuning. No other voltage will be acceptable to AIR at the Transmitters's input circuit breaker .

The technical facilities/ equipment for varying within $\pm 10\%$ of three phase ,4 wire, 400 Volts(rms) should be available at manufactures's works for Testing , measurements and operation checking of the Transmitter, Auxiliary Equipment & accessories 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 , Auxiliary Equipment & accessories etc. 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, other items & the accessories with the requirements as projected in the specifications.

It is mandatory that all these testing and measurements i. e. Operation checking of the Transmitter, Auxiliary Equipment & accessories and measurements at any three frequencies in the VHF band, 88 to 108 MHz without tuning, are carried out well in advance .

These must also be submitted to All India Radio along with the call for inspection of Transmitter, Auxiliary Equipment & accessories well in advance for analyzing etc. Transmitter will be tested for "heat run" for at least 24 hours of continuous operation on full rated power output.

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 manufacturer's works :-**

- A-1.0 Make , type , model no and country of origin & name 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 Working of Transmitter units after removing them outside the Transmitter rack.
- A-7.0 Checking meter readings and calibration.
- A-8.0 Measurements of all parameters as per specification. All the parameters will be measured on any 3 different frequencies in VHF FM band.
- A-9.0 Checking of control and protection system of Transmitter.
- A-10.0 Checking of all power levels, meters, LEDs etc.
- A-11.0 Checking of RF voltages on test points.
- A-12.0 .Inter-changeability of PAs, sub-modules and PCBs .
- A-13.0 Exciter operation, checking and measurements.
- A-14.0 Working of Exciter in all mode as per Specification including Modulating inputs as per specification :
- A-15.0 Measurement of levels in the whole AF and RF chain.
- A-16.0 Checking of all spares, PCB's, modules for the respective transmitter, other items & the accessories .
- A-17.0 Measurements of all parameters as per specification. All the parameters will be measured in respect of other items & the accessories

ANNEXURE-II
TRANSMITTER TECHNICAL DATA TO BE SUBMITTED BY THE TENDERER

S.No.	TRANSMITTER TECHNICAL DATA TO BE SUBMITTED BY THE TENDERER	DETAILS TO BE SUBMITTED BY THE TENDERER	COMMENTS OF TENDERER WITH TECHNICAL DATA / SCHEMATIC DRAWINGS Nos
AII 1.0	Transmitter Dimensions:	Width : (mm) Depth : (mm) Height : (mm)	
AII 2.0	Transmitter weight :	(kg)	
AII 3.0	Transmitter Heat dissipation at 20 kW RF output : KW x 3412 = BTU / Hr	BTU/ Hr	
AII 4.0	Tr AC requirement :	Ton	
AII 5.0	Tr Cooling air requirement:	cubic ft / min cubic M / min	
AII 6.0	Number of Rack	Number	
AII 7.0	Size of Racks: Tr rack Dimensions:	Width : (mm) Depth : (mm) Height : (mm)	
AII 8.0	Air filters Size	Width : (mm) Depth : (mm) Height : (mm)	
AII 9.0	Blowers: Total no. of blowers	Number	
AII 10.0	Power consumption at 20 kW RF output:	kW	
AII 11.0	Typical Power supply line voltages (phase to phase voltages)		
AII 11.1	Voltage between Red phase & Yellow phase:	Volt	
AII 11.2	Voltage between Yellow phase & Blue phase:	Volt	
AII 11.3	Voltage between Blue phase & Red phase:	Volt	
AII 12.0	Typical Power supply phase voltages (phase to neutral voltages)		
AII 12.1	Voltage between Red phase & Neutral:	Volt	

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AII 12.2	Voltage between Yellow phase & Neutral:	Volt	
AII 12.3	Voltage between Blue phase & Neutral:	Volt	
AII 13.0	Typical Power supply line Current/phase Current		
AII 13.1	<u>line Current/phase Current</u> Red phase	Amp	
AII 13.2	<u>line Current/phase Current</u> Yellow phase :	Amp	
AII 13.3	<u>line Current/phase Current</u> Blue phase :	Amp	

* As per list of 20 kW VHF FM transmitter ---- places

List of 20 kW VHF FM transmitter ---- places

SNO.	PLACE	20 kW VHF FM TRANSMITTER
1.	Chauthan Hill	1Number
2.	Raebarelli	1Number
3.	Fazilka	1Number
4..	Amritsar	1Number

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