

Prasar Bharati
(India's Public Service Broadcaster)
Directorate General: All India Radio
Planning & Development Unit
Akashvani Bhawan, Sansad Marg, New Delhi-110001
[FM Design Section]

File No. 5kWMobileTransmitters/BIND-9/4/2020-D(TD/FM)

Dated 29.03.2022

Subject: Specifications for Design, Supply, Installation, Testing & Commissioning (DSITC) of Containerised 5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit, Power Supply System and associated equipments/items in two mobile containers along with Design, Supply, Installation, Testing & Commissioning of Foldable pneumatic/ electro-mechanical tower with trolley, VHF FM Antenna system with RF coaxial cable for use anywhere in India as mobile station/transmitter setup-**regarding Industry feedback & Budgetary quotes**

DG: AIR is planning for getting Design, Supply, Installation, Testing & Commissioning (DSITC) of Containerised 5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit, Power Supply System and associated equipments/items in two mobile containers along with Design, Supply, Installation, Testing & Commissioning of Foldable pneumatic/ electro-mechanical tower with trolley, VHF FM Antenna system with RF coaxial cable for use anywhere in India as mobile station/transmitter setup, on open tender basis. AIR draft technical specification is enclosed for reference.

In this regard, the Prospective bidders from India are requested to give their industry feedback (if any) on the above referred AIR draft Specifications **up to 12.04.2022**. To get an estimated cost, the Prospective bidders from India are also requested to give their budgetary quote for the above referred subject up to **19.04.2022**.

Industry feedback (if any) and budgetary quote may be sent to this Directorate at the following e-mail addresses.

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(Manzoor Ali)
Assistant Director (Engg.)
for Director General

To:

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



for Director General

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

Specifications for Design, Supply, Installation, Testing & Commissioning (DSITC) of Containerised 5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit, Power Supply System and associated equipments/items in two mobile containers along with Design, Supply, Installation, Testing & Commissioning of Foldable pneumatic/ electro-mechanical tower with trolley, VHF FM Antenna system with RF coaxial cable for use anywhere in India as mobile station/transmitter setup.

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A. ESSENTIAL REQUIREMENTS FOR TENDER:

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

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

 (iii) Make/Model and detailed specifications of the equipments/items being offered shall be mentioned categorically, to assess the full merit of the offer, failing which tender shall be considered incomplete and is liable to be rejected. Boarder terms **viz. Equivalent/similar** will not be accepted.
2. Each statement of this specification has to be complied with & supported by printed technical literature, technical data sheets, schematic drawings and technical manuals from the OEM (Original Equipment Manufacturer) by the tenderer, to assess the merit of the offer without which the tender will be considered incomplete and is liable to be rejected.
3. The tenderer should submit the tender offer to AIR (All India Radio) in the format given below, section wise & clause wise, in respect of all the sections of technical specifications. The OEM/tenderer must provide the page number reference, in column (4) of the table given below, of the Technical bid clearly indicating the volume number also, if any, for each supporting document to verify the parametric values shown in the technical specifications compliance statement, to assess the full merit of the offer, failing which tender shall be considered incomplete and is liable to be rejected.

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

4. The tenderer should quote the rate/cost of individual items in the tender offer while submitting the tender offer for spares **(OPTIONAL)** in commercial bid. *Optional items will not be considered for ranking purpose.*
5. The complete technical specifications (Section wise & Clause wise) compliance statements along with Schedule of Requirements/Materials (un-priced) must be signed & stamped by the respective Original Equipment Manufacturer (OEM) in the tender document, failing which the tender shall be considered incomplete and is liable to be rejected.
In case tender offer is from other than the Original Equipment Manufacturer, the tenderer must also sign & stamp the complete Technical specifications (Section wise & Clause wise) compliance statements, failing which the tender shall be considered incomplete and is liable to be rejected. The OEM & tenderer should mention their name in CAPITAL LETTERS & designation of the signatories, full address with pin code, phone number, fax number, e-mail addresses etc.
6. All the volumes of the entire technical bid must be page numbered.
7. The authorization and guarantee must be given by respective Original Equipment Manufacturer (OEM) on their letter head pad duly signed & stamped. In case tender offer is from other than the Original Equipment Manufacturer, the tenderer must also give guarantee on their letter head pad duly signed & stamped, failing which the tender shall be considered incomplete and is liable to be rejected. Guarantee shall be as per the format given in AIR specification.
8. In case tender offer is from other than the Original Equipment Manufacturer, the tenderer should also furnish a certificate from the OEM that the tenderer can quote items of the OEM directly, failing which the tender shall be considered incomplete and is liable to be rejected without any notice/back reference.
9. Any change in the AIR technical specifications format or language or in parameters or of any other nature including the deletion/addition of technical specifications clause, words, lines in the technical specifications compliance statement by the OEM/ tenderer will not be acceptable to AIR and the tender is liable to be rejected.
10. Prasar Bharati will follow the reciprocal market access strategy of the Government of India, which describes on the Clause 10(d) of Public Procurement Preference to Make in India, Order 2017. The Purchaser shall have right for not consider any Bid and may restrict such Bidders from the bidding process; who originate from those countries, where they do not allow market access for Indian companies; in such cases, the Clause 10 (d) of Public Procurement Preference to Make in India, order 2017, shall be invoked wherever applicable, when it is relevant.
11. Amendment in General Financial Rules (GFRs), 2017-Golobal Tender Enquiry issued vide F. No. 12/17/2019-PPD dated 15.05.2020 of Government of India, Ministry of Finance, Department of Expenditure, Public Procurement Division shall be applicable.

B. ESSENTIAL ELIGIBILITY CRITERIA FOR TENDERERS:

- (a) The tenderer shall be from India only.
- (b) The tenderer should either be the OEM of VHF FM transmitters/TV transmitters/AM Transmitters or their authorized representative/dealer in India.
- (c) In case the tenderer is the authorized representative/dealer, the tenderer must be an authorized representative/dealer of any OEM of VHF FM transmitters/TV transmitters/AM Transmitters of power not less than 5 kW for last **three years or more OR** must be in the business of sales and supply of VHF FM transmitters/TV transmitters/AM Transmitters of power not less than 5 kW for last **three years or more**. Documentary evidence to support this must be provided.
- (d) (i) The OEM of the transmitter must have an experience of manufacturing and supplying VHF FM transmitters of power output not less than 5kW for at least last 10 years. Documentary evidence to support this must be provided.
- (ii) The OEM should have supplied VHF FM transmitters to reputed/public broadcasters. The OEM must provide the details of past supply record (**in the format given below**) for at least 10 Nos. of such VHF FM transmitters of power output not less than 5kW, supplied during last 3 years ending last day of the month previous to the one in which the tender is invited. Documentary evidence to support this must be provided.

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

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

(iv) Copies of supply order/Completion certificates/delivery challans/invoice of at least 5 Nos., out of the 10 Nos. of VHF FM transmitters submitted by the tenderer in above format, are also to be enclosed by the tenderer.

- (e) The tower manufacturer should have fabricated and supplied **minimum 5 Nos. of 30m or more SS** tower/foldable Pneumatic/electro-mechanical towers in India in last 5 years. Documentary evidence like supply orders etc. with complete address of customers, must be provided.
- (g) The OEM of the offered VHF FM transmitter must have his local office/authorized representative/dealer in India for after sales support. **A certificate as per Annexure-III** duly signed by the OEM as well as local office/authorized representative/dealer must be submitted with the offer. Copy of Agreement/MoU executed between OEMs and their authorized representative/dealer duly signed by both must also be submitted with the offer.

SECTION-I GENERAL

THE BROAD SCOPE OF THE SPECIFICATIONS IS AS FOLLOWS:

1.0 General Scope:

The specifications is for Design, Supply, Installation, Testing & Commissioning (DSITC) of 5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit, Power Supply System and all associated equipments/items in two mobile containers along with Design, Supply, Installation, Testing & Commissioning of Foldable pneumatic/ electro-mechanical tower with trolley and VHF FM Antenna system with RF Coaxial Cable for use anywhere in India as mobile station/transmitter set up.

The 5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit, Power Supply System and all associated equipments/items in two mobile containers along with Supply & Design of Foldable pneumatic/ electro-mechanical tower with trolley and VHF FM Antenna system with RF Coaxial Cable which can be easily transported anywhere in India as per requirement of organization.

The 5 kW Digital Compatible VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover control unit, Foldable pneumatic/ electro-mechanical tower with trolley, VHF FM Antenna system and all associated equipments/items as per Section-V(A & B), shall be capable of continuous round the clock operation.

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

1.1 Broad Scope of Supplies:

Major Equipments/items to be included:

S. No.	Description of Equipments/items
1.	5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration with automatic changeover unit
2.	10 kW Dummy Load & Thru Line Power Meter
3.	Motorized RF Coaxial Changeover Switch
4.	RF Coaxial Copper Rigid Lines
5.	Pre-wired rack including programme input & monitoring equipments
6.	Audio Automatic Changeover Switch
7.	Stereo FM Digital Audio Broadcast Processor
8.	Power Supply System and associated equipments including Power supply Distribution LT Panel, UPS etc. for Transmitter and associated equipments/items
9.	Air conditioner and ventilation equipment
10.	Mobile Containers with integration/installation of all the above equipments/items
11.	VHF FM Antenna System
12.	RF Coaxial cable
13.	Foldable pneumatic/ electro-mechanical tower with trolley

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

1.3 LANGUAGE / UNITS:

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

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

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

1.4.2. (a) Complete printed technical literature/technical data sheet/schematic drawings/detailed information including Technical Manual (for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description and fault diagnosis) of 5 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter in (1+1) configuration and associated equipments/items as per Section-V(A&B) from the respective Original Equipment Manufacturer (OEM) in support of compliance statement should be furnished, **to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

(b) The tenderer is required to submit complete details like General Scope, Layout of container design, Main body construction including materials used, flooring, Panelling, Insulation for walls & floors, windows, hatch Panels, Power supply provisions, Jack, air-conditioning, painting & colour scheme, Fire extinguishers, ladder etc. as per AIR specifications, **to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

The tenderer is also required to provide isometric view of both the containers with separate sections, plans and elevations showing complete equipment layout with dimensions, **to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

(c) The tenderer is required to provide complete details including isometric view of of the pneumatic/ electro-mechanical tower with trolley as per AIR specifications, **to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

(d) The tenderer is required to submit the detailed proposal of the technical offer complete in all respect including Design, Supply, Installation, Testing & Commissioning keeping in view the scope as defined in AIR specifications, **to assess the full merit of the offer, without which the tender offer will be considered incomplete and liable to be rejected.**

- 1.4.3.** Detailed Schedule of Requirements/Materials (un-priced) for the supply of Containerised Mobile 5 kW Digital Compatible VHF FM solid-state MOSFET technology based broadcast transmitter in (1+1) configuration and associated equipments/items for each site should be in conformity with Section-V(A&B) without any change in the format, **failing which the tender will be considered incomplete and is liable for rejection. The tenderer must quote all items.**
- 1.4.4.** Descriptive information and complete details of each equipment offered shall be given by the tenderer.
- 1.4.5.** Country of Origin, Make, Type & Model of all the offered items should be mentioned including the name & address of their vendors.
- 1.4.6.** The performance figures of the offered equipment/items must be given by the tenderer, **to assess the merit of the offer, without which the tender will be considered incomplete and liable to be rejected.**
- 1.4.7** A copy of Technical Manuals {for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}, must be enclosed with technical bid for assessing the transmitter system. The Technical Manual must include at least the details given below:
- (a) The Installation Manual must describe the following information:**
- (i) A detailed write up in English only regarding VHF FM transmitter system along with its associated equipments/items.
 - (ii) Diagrams showing the isometric view of VHF FM transmitter and associated equipment with dimensions in metres/mm.
 - (iii) The procedure of alignment and adjustment of various assemblies & sub-assemblies of VHF FM transmitter such as Exciter, PA, Control Circuit, output stage etc.
 - (iv) **All Do's and Don'ts which are essential for safe installation of the transmitter system.**
 - (v) An inter-wiring diagram for all transmitter units/modules installed in the transmitter rack, input/output to transmitter and interlocks with external units and accessories like dummy load, changeover switches, patch panel etc. which are wired in the transmitter interlocks.
- (b) Operation, Maintenance & Servicing Manual must describe the following:**
- (i) General description of the offered VHF FM transmitter, transmitter block diagram/schematic drawings indicating the details of different blocks, modules and redundancy incorporated in transmitter and its subsystems.
 - (ii) Details regarding Digital Compatible of the offered VHF FM transmitter for HD Radio and DRM+ mode for future up-gradation with block diagram/schematic drawings.
 - (iii) General description and structural overview of the transmitter racks indicating the position of different modules, units, power distribution etc.
 - (iv) Colour Photographs of transmitter showing the following:
 - (a) Front, Rear and Top view of the transmitter.
 - (b) Front and rear view of PA, Exciter & Control Unit.
 - (c) View of PA with cover opened showing full view of Pallets/RF Boards, various adjusting pots and field replaceable parts.
 - (d) Enlarged open view of PA showing at least two RF transistors and bias adjustment pots etc.
 - (e) Open view of Exciter Unit.
 - (v) Screen shots of various display screens showing monitorable and measurable parameters of transmitter.
 - (vi) A detailed description of working of circuits with all relevant circuit diagrams (components, parts of

- circuit diagrams will be co-related with circuit description provided) of the complete transmitter system should be provided with details of test points.
- (vii) The details of all electrical circuits in various stages of the transmitter used along with their detailed write-ups.
 - (viii) General description of **RF signal flow diagram for complete RF chain from exciter to filter output with information about power level at input & output of each stage. Losses and gains in various stages including power dividers, combiners, etc. must also be shown.**
 - (ix) Description of transmitter interlocks, protections under abnormal conditions and schematic drawing indicating interconnections to different transmitter units, external units and accessories like dummy load, changeover switches, patch panel etc. which are wired in the transmitter interlocks.
 - (x) Details and schematic drawings of cooling system with description.
 - (xi) Details and schematic drawings of remote monitoring and control facilities of the transmitter along with screen shots of the interface displays. The transmitter parameters that can be remotely monitored and controlled.
 - (xii) General description of transmitter control system, schematic drawing(s) for control signal distribution including pin details of relevant connectors.
 - (xiii) General description of exciter unit, block schematics showing details of all sub units, Exciter front and rear views indicating all inputs, outputs and interfaces.
 - (xiv) General description and architecture of Power Amplifier's block schematic drawings, Front and rear views indicating all inputs, outputs and interfaces.
 - (xv) Description of measurement of DC voltages, currents and RF power of PA.
 - (xvi) Description of protection mechanism against high VSWR, overload, high temperature of the exciter, Power Amplifiers and transmitter system.
 - (xvii) Description of VSWR/temperature foldback alongwith range of foldback. The explanation of foldback with the help of circuit diagram.
 - (xviii) Details of splitter and combiner system's schematic drawings used in the transmitter.
 - (xix) Description of various interfaces, connectors, connecting cables and accessories used in the VHF FM transmitter.
 - (xx) A complete list of all parts/transistors/ICs/components (alongwith part numbers of OEM of the components) used in the transmitter.
 - (xxi) The make and number of LDMOS/MOS devices used in the power amplifier must be mentioned clearly.
 - (xxii) Technical data sheet of all high power RF devices/RF components used in the transmitter.
 - (xxiii) Procedure for changing the frequency of operation of the transmitter.
 - (xxiv) The detailed procedure and possibilities of by-passing control circuit with diagrams.
 - (xxv) The description of manual operation of control system including cooling system.
 - (xxvi) All the screen shots of display of control unit in sequential manner for operation, monitoring and control of each unit viz., Exciter, PAs, cooling systems, power supply, various settings in software etc.
 - (xxvii) **All Do's and Don'ts which are essential for safe Operation & Maintenance of the transmitter.**
 - (xxviii) Various test fixtures and accessories required for the maintenance/repair of the VHF FM transmitter.
 - (xxix) The detailed procedure for troubleshooting of the VHF FM transmitter preferably up to component level.
 - (xxx) The systematic troubleshooting /fault tree and flow diagram should be provided for diagnosis of the faults with their remedial measures.
 - (xxxi) General description of electrical power distribution and schematic drawing of power supply system used for the transmitter system.

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

- (i) Transmitter including automatic changeover control unit
- (ii) Dummy Load
- (iii) Thru line power meter (s)
- (iv) RF coaxial copper rigid lines & accessories
- (v) Motorized RF coaxial changeover switch
- (vi) Audio Processor (s)
- (vii) Pneumatic/ electro-mechanical Foldable tower with trolley
- (viii) PI Rack
- (ix) VHF FM Antenna System
- (x) RF Coaxial cable
- (xi) Power supply System and equipments

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

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

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

One set of **Technical Manuals** {containing all the details as in 1.4.7(a) & (b) for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}, **COLOUR** printed and duly bound, for 5kW Digital Compatible VHF FM transmitter in (1+1) configuration, Automatic Changeover Unit (ACU), Dummy Load, Thru Line power meter, Motorized RF coaxial changeover switch, RF coaxial copper rigid line, Remote Monitoring & Control facility, Antenna System, RF coaxial cable, Pneumatic/ electro-mechanical foldable tower, Power supply equipments/items etc. along with one soft copy on pen drive must be supplied to "The DDG (E-FM), P & D Unit, DG: AIR, New Delhi-110001", **for examination and approval.**

1.6 INFORMATION TO PRECEDE DESPATCH OF EQUIPMENT:

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

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

1.7 DOCUMENTS/INFORMATION TO BE SUPPLIED ALONG WITH EQUIPMENT:

Technical Manuals (duly approved by AIR) {containing all the details as in 1.4.7(a) & (b) for Installation, Testing, Commissioning, Operation, Maintenance & Servicing, including theory of operation, circuit description with detailed circuit drawings and fault diagnosis}, **COLOUR** printed and duly bound, for 5kW Digital Compatible VHF FM transmitter in (1+1) configuration, Automatic Changeover Unit (ACU), Dummy Load, Thru Line power meter, Motorized RF coaxial changeover switch, RF coaxial copper rigid line, Remote Monitoring & Control facility, Antenna System, RF coaxial cable, Pneumatic/ electro-mechanical foldable tower, Power supply equipments/items etc. and inspection report shall be supplied as per the details given below:

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

1.8 DELIVERY:

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

1.9 PACKING AND PACKING LISTS

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

1.10 INSURANCE AND MARINE RISKS ETC.

Please refer to commercial terms.

1.11 GUARANTEE:

The tenderer shall submit with his offer an undertaking to accept the following guarantees:

{This Guarantee clause is applicable to Transmitter as well as all the associated equipments/items mentioned in Schedule of Requirements/Materials (un-priced)}.

- (i) A guarantee that the equipment supplied will be in accordance with these specifications, varied only to the extent stated in his tender and agreed to in the contract.
- (ii) A guarantee to make good within 15 days (from the date of first intimation to OEM/tenderer) at tenderer's expense any component which becomes defective under normal operating conditions for **60 months** from the date of supply. If the tenderer failed to rectify the fault within the stipulated period of 15 days, the guarantee period for that particular equipment/item would be extended corresponding to the outage period.
- (iii) A guarantee to supply all components for a period of ten years from the date of supply, at rates at which these are being supplied by the firm to other customers and also should match prices of original manufactures of these components prevailing at that time.
- (iv) If at any stage during next 10 years, the manufacturer stops production of this model of transmitter, the firm shall intimate All India Radio in advance to enable the latter to stock the critical items.

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

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

A. INSPECTION OF TRANSMITTERS:

- a). Detailed Pre-dispatch Inspection (PDI) of transmitters on dummy load will be carried out at OEM's Works by **two Engineers** of All India Radio as per details given in **Annexure-I**.
- b). Call for Pre-dispatch Inspection (PDI) is to be given by the tenderer to All India Radio at least **6 weeks** in advance. Testing/measurement reports as per approved ATP along with approved copy of Technical Manual (s) must be submitted to All India Radio along with the call for inspection of transmitters for analyzing etc. These testing/measurement reports and approved copy of Technical Manual (s) must also be available at the time of inspection of the transmitters.
- c). Inspection period will be two days for each Set (1+1) transmitter and one additional day to test the compatibility of the transmitter for HD or DRM+ mode.
- d). For AIR inspecting engineers, expenses toward to and fro air journey, boarding, lodging etc. will be borne by All India Radio.

(B) INSPECTION OF FOLDABLE PNEUMATIC/ ELECTRO-MECHANICAL TOWER WITH TROLLY:

Inspection of the foldable pneumatic/ electro-mechanical tower with trolley shall be carried out as defined in Section-IV (J).

(C) INSPECTION OF POWER SUPPLY EQUIPMENTS:

Detailed inspection of Power Supply Equipments like DG Sets etc. will be carried out at tenderer's system integrator's works

(D) INSPECTION OF ASSOCIATED EQUIPMENT/ITEMS:

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

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

(E). INSPECTION OF THE COMPLETE SETUP

Final inspection of the complete setup in all respect after integration/installation of transmitter and all equipments/items in two containers shall be carried out at tenderer's system integrator's works by AIR Engineers as per mutually agreed ATP to confirm the performance of the equipments as per AIR specification.

(F). SITE ACCEPTANCE TEST (SAT)

Site Acceptance Test (SAT) shall be carried out after installation at respective sites, before finally taking over/accepting the equipment.

1.13 TRAINING:

- a. OEM's Engineer(s) shall train about 20 (Twenty) AIR Engineers for 5 working days at any one AIR site / Delhi to enable them to become acquainted with all particulars as well as installation, operation, maintenance, trouble shooting of the transmitter and associated equipments at no cost to AIR. However, AIR shall bear all touring expenses of AIR Engineers deputed for training and the same is not to be included by the tenderer in their offer.
- b. The training shall cover theoretical concepts, demonstration of salient features, configuration of transmitter, operational, maintenance & servicing, fault finding, circuit tracing, component/ module replacements, trouble shooting, preventive maintenance, remote control operation and other relevant topics etc. related to the transmitter.
- c. Training material in hard and soft copies are to be provided by the OEM to each AIR engineer undergoing the above training.
- d. **Colour printed & duly bound** two sets of training lecturer notes, schematic drawings, hand books etc. shall be supplied to DDG (E-FM), P&D Unit, DG: AIR before commencement of training.

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

- (a) The OEM should have complete setup for maintenance/repair of the transmitter in India, either of its own or through local office/authorized representative/dealer.
- (b) The local office/authorized representative/dealer will be the nodal point for resolving issues related to after sales support. It is the responsibility of local office/authorized representative/dealer to arrange the repair/replacement of faulty items. Any module of transmitter or other equipment requiring repairs will be repaired. If it is not feasible to repair the module at site, the same will be collected from the site by local office/authorized representative/dealer that will arrange repairs locally. The cost of transportation, repairs etc. shall be borne by the tenderer during the guarantee period.
- (c) After sales support for the repairs/maintenance of transmitter system after the completion of guarantee period, shall also be provided by the respective OEM of the transmitter and other associated equipments through their local offices/authorized representatives/dealers in India.
- (d) The details of technical facilities available with local office/authorized representative/dealer **for after sales support such as test bench, necessary test & measuring equipment and photographs thereof, must be provided in the technical bid.**
- (e) At the discretion of AIR, the representative(s) of AIR may visit the works of local office/authorized representative/dealer of OEM in India to ensure/verify that adequate technical infrastructure is available for after sales service for timely resolving the issues related to attending/replacing the equipments. Tenders from the tenderers who failed to meet these criteria shall be considered incomplete and is liable to be rejected.

1.15 SPARES (Optional):

- (a) The minimum recommended essential spares as per Section-V(B) and any other critical spares suggested by the OEM, required to maintain the continued service of the transmitter in a reliable manner, shall be quoted by the tenderer.
- (b) The minimum recommended essential spares may be based on predicted rate of failure.
- (c) In case, the tenderer quotes the optional items as 'a set', the details of the components/items offered in the

‘set’ must be spelt out clearly including their Make & Model and quantity, failing which the tender offer is liable to be rejected.

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

1.16 ENVIRONMENTAL CONDITIONS FOR TRANSMITTER AND ALL ASSOCIATED EQUIPMENT:

Outside temperature range	:	-30° C to + 40° C
Ambient temperature range for operation	:	0° C to + 40° C
Relative humidity	:	95 percent, non-condensing
Working altitude	:	Up to 4500 meters AMSL

1.17 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

1.18 POWER SUPPLY FOR SINGLE PHASE EQUIPMENTS:

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

1.19 DEMONSTRATION OF THE OFFERED EQUIPMENT THROUGH WEB CONFERENCING:

The tenderer will have to arrange a demonstration of the offered Transmitter through web-conferencing during technical evaluation stage, if required by AIR, within 10 days of the issue of request letter. Accordingly, the tenderer should be in readiness for web demonstration, failing which the tender offer is liable to be rejected without any further correspondence.

Functional checking as per AIR specification under Section-II and performance measurements as per AIR specification under Section-III will be carried out on a single transmitter during web demonstration. The tenderer is also required to show the Digital compatibility of the transmitter (HD OR DRM+) during web demonstration. Complete system in (1+1) configuration will be carried out during PDI only.

The tenderer will also have to make all necessary arrangement for functional checking/testing of the offered transmitter with full rated power including equipments required for checking the digital compatibility of the transmitter in (HD OR DRM+) during web demonstration. All expenses & liabilities for demonstration through web-conferencing of above offered VHF FM transmitter will be borne by the tenderer. This web demonstration will be purely for Technical Evaluation of the offered VHF FM transmitter and is without any commitment for acceptance of offer.

SECTION-II

2.0 TRANSMITTER CONFIGURATION:

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

- a) Each 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter shall be supplied with single Exciter unit.
- b) 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter shall be configured to operate in (1+1) mode. The second 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter will work as hot or active standby in automatic change over mode (with manual override). The operation in (1+1) configuration is done by an Automatic Changeover Unit (ACU). The automatic changeover of Transmitter should take place when power of active Transmitter goes down by $\geq 3\text{dB}$.
- c) The audio shall be fed to both the Transmitter Units from single external audio source and therefore, proper arrangement of feeding the audio (Analog L/R, AES/EBU, RDS/DARC, SCA) to both the Transmitters through audio distribution unit shall be made.
- d) 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration should have provision for automatic switching of either 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter to the Antenna & Dummy load. The automatic changeover of transmitter should take place when power of active transmitter goes down by $\geq 3\text{dB}$.
- e) 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter shall be frequency agile and capable of giving $\geq 5\text{ kW}$ power continuously with minimum of 5% headroom.
- f) The 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter should be compatible for HD Radio and DRM+ mode for future upgradation. However, **HD/DRM+ Equipments shall not be the part of supply in respect of this tender.**
- g) The 5 kW Digital Compatible VHF FM Solid-State MOSFET technology based Broadcast transmitter should have the facility on the front panel of the transmitter for selection of either FM Mode **OR** Digital Mode **OR** (FM + Digital Mode) so that external HD Radio **OR** DRM+ Modulator is selected in place of FM Exciter.
- h) The Power Amplifiers of the 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter should be able to switch into class AB linear mode for OFDM use without any requirement of modifications in the supplied transmitter equipment.
- i) The transmitter will be complete in all respects. All India Radio will provide three phase, 4 wire power supply at a single point as per Section-I. All other transmitter's inbuilt subsystem shall derive supply through this source. No other voltage will be acceptable to AIR at the transmitter's input circuit breaker and failing which the offer is liable to be rejected. The performance of transmitter as per parameters in Section-III should be ensured without degradation with the given power supply tolerances.
- j) The transmitter should be capable for unmanned 24×7 operations.

- k) Both transmitter equipment of (1+1) configuration shall be housed in separate rack having pleasing appearance. All metal works shall be protected against rust and corrosion. All materials used in transmitter shall be non-inflammable and fire retardant.
- l) All stages i.e. Exciter unit, IPA (as the case may be), PAs, combiner, harmonic filters etc. should be frequency agile and capable of operation in the entire VHF Band i.e. 88 MHz to 108 MHz **without** change of any component.
- m) The transmitter shall be suitable for Mono and Stereo FM Radio Broadcast.
- n) Transmitter should be of modular design for easy maintenance & part replacement. It should be possible to take out PA module without “switching off” the transmitter.
- o) The transmitter construction shall ensure complete shielding of high power RF circuits to minimize radiation. The FM transmitter will have to work in a common transmitter hall having other high power Medium Wave transmitters, Short Wave transmitters, TV transmitters in VHF & UHF band as well as other FM transmitters. Therefore, the transmitter should be adequately protected from resultant E.M.C. (Electro Magnetic Compatibility) as per ETS-300447.
- p) It should comply with IEC 60215 safety standards so as to eliminate hazards to personnel. Access to parts carrying dangerous voltages shall be through interlocked doors.
- q) The transmitter will consist of solid state devices such as MOSFETS in IPA (if applicable)/PA stages. It must have auto ramp up circuit for power rise when transmitter is “Switched-On”. It should be possible to vary the transmitter power from a low value (minimum 1 kW or less) to full value from front control panel. Details to be provided by tenderer.
- r) The Power Amplifiers and Exciter Unit of one transmitter should be interchangeable with second transmitter and vice-versa.
- s) **The life of transmitter should be at least ten years and it must be certified by the OEM.**

2.1 Exciter:

- 2.1.1 The Exciter should have Direct Digital Synthesis. It should accept Analog Mono, Analog Stereo (left and right) / Encoded Stereo signals (MPX), RDS/DARC, SCA and AES/EBU inputs. It should be compatible for Mono and Stereo Broadcasting using pilot tone system.
- 2.1.2 It should have its own manually adjustable power control. The pre-emphasis should be selectable/switchable.
- 2.1.3 It should display various parameters like forward Power, reflected power, frequency deviation and input audio level on its front Panel. Status and faults should also be indicated.
- 2.1.4 It should be synthesized with easy channel selection of minimum 10 kHz spacing i.e. can be operated on any of the frequency in VHF Band i.e. 88 MHz to 108 MHz. The Exciter should be **“Frequency agile”** i.e. not requiring any tuning over its entire specified operating frequency range.

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

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

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

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

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

The tenderer shall offer 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration in separate cabinet/rack i.e. separate rack for each transmitter. No other combination shall be acceptable.

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

S. No.	Number of PA Unit failure	Transmitter RF Power Output in kW
1.	One No.	..... kW
2.	Two Nos.	..... kW
N	N...Nos.	..... kW

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

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

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

- 2.6.1 Protection against over loads, transients, severe fluctuation/variation in power supply, any other malfunctioning etc. for transmitter as well as individual PAs etc.
- 2.6.2 Protection against over temperature on heat sinks.
- 2.6.3 Protection against air/liquid flow failure and less volume of cooling.
- 2.6.4 Protection against high VSWR including open and short conditions at output.
- 2.6.5 Immediate power fold back under severe/damaging fault conditions of VSWR and temperature. The

- power of transmitter should automatically come down to a suitable safe design limit, so that the transmitter and its subsystems do not get damaged due to load mismatch/ high temperature.
- 2.6.6 Transmitter should be protected against lightning by providing DC/RF discharge path and details of the same are to be given.

2.7 Control and Interlocking:

- 2.7.1 The control and interlock circuits shall ensure protection and operational safety of the equipment and personnel. They shall allow the transmitter to be “switched-in” or “out-of-service” in a proper sequence only by operation of switch buttons or manual controls on transmitter panel. Switching-in of the auxiliary units such as Dummy Load, Reject Loads, exhaust fan etc. shall be suitably interlocked. External units and accessories like Dummy Load, Change over Switches etc. should be wired in transmitter interlock.
- 2.7.2 Details of the control/monitoring/protection unit should be given.
- 2.7.3 It should be possible to switch off the entire transmitter in emergency by the operation of a single push button/manual command. This should be on front panel.
- 2.7.4 Stages of sequential operations of switching “ON” and “OFF” of the transmitter shall be indicated by use of suitably coded electronic display or through WEB GUI. In addition, all protections as indicated in clause 2.6 shall remain indicated until reset. The fault indication shall be supplemented with audible alarm.

2.8 INSTRUMENTATION & INDICATIONS :

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

- 2.8.1 Transmitter status and fault conditions shall be indicated by colour coded display.
- 2.8.2 Transmitter shall have the facility to display Forward and reflected transmitter output power.
- 2.8.3 Suitable test points for operational check outside the module shall also be provided.
- 2.8.4 RF Outputs sample (Forward and Reverse) should be provided on connectors for performance measurement.

2.9 COOLING SYSTEM:

Full details of cooling system (Air Cooled/Liquid cooled) and subsystems shall be given. Details of cooling system and filters shall be given. Quantum of heat required to be handled by the cooling system is also to be indicated. Any special space requirement for installation of cooling system is also to be indicated. However, in case of air-cooled transmitter, open looped cooling system shall be deployed with the provision of fresh air with filters etc. The filters shall be of washable type and 5 Sets of filter shall be provided with each transmitter unit. Exhaust duct shall be provided with two-way louvers for recycling exhaust air, if required.

2.10 TRANSMITTER POWER SUPPLY:

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

The AC and DC supply should have their protective devices. The rectifier and filter circuits should be able to take care of switching voltage surges on power lines. Adequate metering / indications like DC voltage and current to be provided. Power supply unit to be protected against “over temperature”, “over-current” and “over-voltage”, transients etc. The unbalance between the phases shall not exceed by 10% of the total line/phase current during normal conditions of operation. The tenderer shall provide following technical details as per table given below, failing which the offer is liable to be rejected.

Transmitter Power in kW	Phase Current (I _R) Amp.	Phase Current (I _Y) Amp.	Phase Current (I _B) Amp.	Neutral Current (I _N) Amp.
1				
2				
3				
4				
5				

2.11 AUTOMATIC CHANGEOVER CONTROL UNIT (ACU):

- One Automatic Changeover Unit (ACU) for operating the transmitter in (1+1) configuration to facilitate automatic switch “ON” of the 2nd transmitter Unit in case of failure of RF output of 1st transmitter Unit shall be offered by the tenderer.
- Any one of the 5 kW Digital Compatible FM transmitter unit shall be selectable as master or slave automatically in active standby mode. When the RF power of the 1st transmitter goes down by 3 dB or more, it should be sensed as a failure to switch to second transmitter automatically. In case of failure of the complete system, there should be provision of three trials wherein against each trial, the time shall be adjustable up to 1 minute individually before final switch OFF.
- Arrangement shall be made for bypassing the ACU in case of its failure so as to enable operating personnel to operate the transmitters in the manual mode.
- Power Supply to the ACU shall be fed through the UPS.
- The changeover time between the two transmitters should be ≤ 30 seconds.

2.12 REMOTE MONITORING AND CONTROL FACILITY:

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

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

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

MIB files will be provided by tenderer, if applicable.

SECTION-III

TECHNICAL SPECIFICATIONS OF TRANSMITTER

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
3.1	GENERAL	
3.1.1	Frequency Range	88 MHz to 108 MHz
3.1.2	Nominal Frequency Deviation	± 75 kHz (peak)
3.1.3	Maximum Frequency Deviation	± 100 kHz (peak)
3.1.4	Frequency Setting	Direct from front panel in 10 kHz steps
3.1.5	Class of Emission	180KF8E
3.1.6	Stereo Transmissions	Pilot tone system
3.1.7	Pre-emphasis	0, 50 μ s (selectable).
3.2	RF OUTPUT:	
3.2.1	Rated Output Power	≥ 5 kW continuous with minimum headroom of 5%.
3.2.2	Output (Load) Impedance	50 Ω unbalanced.
3.2.3	Permissible VSWR	1.5: 1 with full power. Power fold-back beyond 1.5: 1. Details of power fold back characteristics to be provided.
3.2.4	Harmonics and Spurious Suppression	Within limits as per Radio Regulations & ITU-R Rec The actual values are to be indicated.
3.2.5	Overall Efficiency (AC to RF Out) for FM (Analog) Mode only	≥ 70 %.
3.2.6	RF Output Connector	1-5/8" with EIA flange
3.2.7	Max. Frequency Tolerance	As per ITU-R Rec.
3.2.8	Synchronous AM S/N Ratio referenced to 100% AM modulation at 400 Hz, 50 μ s Pre-emphasis with FM modulation at ± 75 kHz deviation.	Better than 50 dB
3.2.9	Asynchronous AM S/N Ratio unweighted, referenced to 100% AM modulation at 400 Hz, 50 μ s Pre-emphasis and without FM modulation.	Better than 55 dB
3.3	INPUTS:	
3.3.1	Modulating Input Signal	Exciter should accept Analog Mono, Analog Stereo (left and right)/Encoded Stereo Signals (MPX), AES/EBU, RDS/DARC and SCA inputs. It should be capable for Mono and Stereo Broadcast using pilot tone system.
3.3.2	(i) Input Impedance (Analog)	10 k Ω or greater (for Mono) 10 k Ω or greater (for Stereo)
	(ii) Input Impedance (AES/EBU)	110 Ω Nominal
3.3.3	Analog and AES/EBU input Level for ± 75 kHz (peak) Deviation:	ANALOG AUDIO INPUT: Input Level adjustable from -6 dBu to +6 dBu AES/EBU AUDIO INPUT: Input Level adjustable from -12dBFS to 0dBFS

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

3.10 TECHNICAL SPECIFICATIONS OF REMOTE MONITORING AND CONTROL FACILITY:

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
1.	Remote Monitoring and Control Facility (Controllable Settings/Parameters)	1. Transmitter: ON/OFF 2. Exciter: ON/OFF 3. RF Output Power Level Control 4. Audio input level 5. Selection of Transmitters 1/2.
2.	Remote Monitoring and Control Facility (Monitorable Settings/Parameters)	1. RF forward and reflected power of Exciter 2. RF forward and reflected power of each Power Amplifier 4. Power supply status i.e. Voltages, Currents etc. 5. Alarm Indications: Temperature, VSWR, ON AIR, Audio etc. 6. Demodulated audio/data 7. Any other parameters which the manufacturer considers essential for proper control /functioning of a remote-controlled FM transmitter.
3.	Data Format	To be indicated by tenderer and compatible for above system.
4.	Data Rate	To be indicated by tenderer and compatible for above data format.
5.	Software and Hardware Items	Software and complete hardware items required for remote monitoring and control of transmitter shall be part of the supply of the transmitter. Details of offered items are to be given by the tenderer.
6.	Laptop	11 th Generation or higher, Intel Core i7 processor or higher, minimum 15.6" FHD Screen, 16 GB RAM, Windows-10 or latest Operating System, Hard drive (Solid State Drive) \geq 512GB, 2 x USB 3.2 ports, Headset Jack, HDMI (2.0), RJ45

SECTION IV- TECHNICAL SPECIFICATION OF ASSOCIATED EQUIPMENTS/ITEMS

SECTION-IV (A) - TECHNICAL SPECIFICATIONS OF 10 kW AIR COOLED DUMMY LOAD AND THRU LINE RF POWER METER

4.1 Dummy Load: One number, 10 kW forced air cooled Dummy Load, 50 Ω are to be quoted for transmitter as per technical specifications given below.
All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATION
4.1.1	Power Rating	10 kW continuous
4.1.2	Connector	1-5/8" EIA Flange
4.1.3	Frequency Range	88 to 108 MHz
4.1.4	VSWR	$\leq 1.10:1$
4.1.5	Impedance(Nominal)	50 Ω
4.1.6	Load Cooling	Forced Air cooled
4.1.7	AC Power Supply	As per Section –I
4.1.8	Dimensions (Length x Width x Depth)	To be given by the tenderer.
4.1.9	Weight	To be given by the tenderer.
4.1.10	Environmental Conditions	As per Section –I

THRU LINE RF POWER METER

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATION
4.1.11	RF Power Meter (dual type) with simultaneous FORWARD & REFLECTED power measurement suitable for mounting in 19" rack with separate Transducers/Sensing elements for measuring forward (≤ 10 kW) & reflected (≤ 1.0 kW), elements sockets, line section and 1-5/8" EIA flanges including all accessories, cables complete (2 Nos.) as per specifications for connecting with the rigid line. All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.	1 Set
4.1.12	Power Rating: Forward Power	10 kW continuous
4.1.13	Power Rating: Reflected Power	1.0 kW
4.1.14	Frequency Range	88 MHz to 108 MHz
4.1.15	VSWR	$\leq 1.1:1$
4.1.16	Impedance	50 Ω
4.1.17	Accuracy	$\pm 5\%$ or better
4.1.18	Directivity of Line Section	30 dB or better
4.1.19	VSWR of Line Section	$\leq 1.05:1$
4.1.20	AC Power Supply	As per Section –I
4.1.21	Dimensions (Length \times Width \times Depth)	To be given by the tenderer.
4.1.22	Weight	To be given by the tenderer.
4.1.23	Environmental Conditions	As per Section –I

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

4.2 Motorized RF Co-axial Changeover switch: Four ports, 1-5/8" Motorized RF coaxial Changeover switch fitted with 1-5/8" matching EIA flanges for connecting rigid line, including control panel, is to be quoted as per technical specifications given below. RF coaxial switch should work in manual mode also. All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.		
S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
4.2.1	No. of Ports	4
4.2.2	Input Ports, Output Ports, Termination/Dummy Load Port	1-5/8" EIA male
4.2.3	Frequency Range	88 MHz to 108 MHz
4.2.4	Impedance (Nominal)	50 Ω
4.2.5	Power Supply	As per Section –I
4.2.6	Control Voltage	As per Section –I
4.2.7	Average Power Handling Capacity	≥ 12.0 kW
4.2.8	Isolation	≥ 60 dB
4.2.9	VSWR	≤ 1.05
4.2.10	Insertion loss	≤ 0.1 dB
4.2.11	Mechanical life	$\geq 1, 00, 000$ operations
4.2.12	Switching time	≤ 2 sec.
4.2.13	Signaling and Interlock Contacts	The interlock contacts should be coupled with RF contacts for interrupting RF power before and during switching. They should open before the RF contacts separate and closes after the RF contacts are in their new position. The auxiliary contacts should be suitably rated.
4.2.14	Dimensions (Length \times Width \times Depth)	To be given by the tenderer.
4.2.15	Weight	To be given by the tenderer.
4.2.16	Control panel	Suitable for above Motorized RF co-axial Changeover switch.
4.2.17	Environmental Conditions	As per Section-I

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

4.3 Transmitter power will be fed to the Antenna System by an internal 1-5/8" RF coaxial copper rigid line and then an external air dielectric RF coaxial cable of suitable size.

Following are the Technical Specifications of RF coaxial copper rigid lines & associated accessories: All RF coaxial copper rigid lines with associated accessories are to be offered as per details given in SECTION-V(A). RF coaxial copper rigid lines and associated accessories should be of standard make. All the technical specifications/parameters are to be supported with printed technical literature/data sheet etc. from the OEM.

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

SECTION IV, D-TECHNICAL SPECIFICATION OF PRE-WIRED RACK INCLUDING PROGRAMME INPUT & MONITORING EQUIPMENTS

5.0 PRE-WIRED RACK INCLUDING PROGRAMME INPUT & MONITORING EQUIPMENTS:

- (i) Pre-wired Rack shall house Audio Processor, (an approx. space of 19"x 4.0"x16.5" may be kept blank at upper side for Mod. Monitor), Analogue Stereo Distribution Amplifier, Digital Distribution Amplifier and shall have two numbers (2 Nos.) of Stereo Jack Strip/Audio Patch Panel for analog audio signal and two numbers (2 Nos.) of Stereo Jack Strip/Audio Patch Panel for AES/EBU signal inputs and suitable connectors for Analog Audio (Stereo), AES/EBU (Digital) Audio, SCA, RDS/DARC inputs.
- (ii) Pre-wired Rack shall be provided with cable trays, **wiring including for Mod. Monitor**, tag blocks, terminal strips, BNC connectors, repeat coils, attenuators 0-15 dB, necessary modulating inputs level control in steps, facility to measure audio levels at various points in the programme chain with a PPM meter and monitor audio levels at various points in the programme chain with an ampli-speaker (1+1) with mounting arrangement, selector switch, ventilation arrangement and other accessories as per AIR specifications. For Audio Chain reference, AIR drawing No. TE-16750 is enclosed.
- (iii) There will be two external sources of audio from the output of two Set Top Boxes (DTH) [to be provided by AIR]. The audio shall be fed to both the Transmitters via Distribution amplifier from one external source as selected by the Automatic Audio changeover switch.

5.1 GENERAL: It shall be a standard 19" Rack conforming to professional standards of sound broadcasting for mounting equipment and accessories having lockable rear door and side panels.

5.2 MECHANICAL:

- (i) Construction Details: The rack shall be sturdily constructed from anodized aluminum extrusion sections of suitable size fastened to form framework properly reinforced with stiffeners, suitably welded. The front side of the rack shall be open for mounting equipments. The rear side of the rack shall be provided with a single leaf, hinged removable type door and handle with latching arrangement. The sides should be covered with panels which can be screwed to the frames. These panels should be reinforced with stiffeners. The Racks shall have holes for grouting bolts on the bottom plate. The thickness of the sheet used for sides of the rack and door shall be 1.6mm and 1.3mm respectively.
- (ii) Mounting Arrangement: Panel mounting rails with pre-drilled and tapped holes corresponding to metric thread 'MS' are to be provided at the front. Suitable mounting arrangement is to be made at the top and the bottom of the frames for mounting the rails at different intervals. Pre-drilled holes shall be such that it shall be possible to mount any standard equipment of width 483mm and height 1U to 4U. Necessary equipment support angle to relieve strain on holding screws wherever required shall be provided. Any equipment which is less than standard 19" width shall be provided with rack mount kit.
- (iii) Style/Strips or Trims: To render sleek look style, strips/trims are to be provided on the front side which will cover the drilled holes on the mounting rails.
- (iv) Ventilation Arrangement: Louvers are to be provided throughout the length of rear door of the rack. Provision is required to be made for mounting a cooling fan of minimum 100 CFM at the top.
- (v) Finish of the Rack: The inside and outside of the rack shall be powder coated (dark grey matt finish).

5.3 JACK STRIP FIELD/ AUDIO PATCH PANEL:

- (i) Standard Jacks Strip of robust construction and positive action shall be used. Input and output of all the equipments and the programme lines shall be brought to the Jack Field. Few jack points shall be used as check points without disrupting the signal flow & few to be left as spares for the tie lines, parallel points and for future use. The jack strip panels shall be openable on front sides without strain on connector and wiring.
- (ii) Jack Strip construction: The jacks shall have preferably a nickel plated brass frame, with nickel-silver springs and gold-silver/ Palladium contacts. The jacks shall be mounted on 20mm centers. The Jacks shall be as per DIN specifications.
- (iii) Contact arrangement: Each jack shall be a 24 point jack, providing a break circuit (on both wires) and an isolated earthing lug.
- (iv) Indicating strip: A strip covered with transparent plastic shall be provided above the row of jacks for labeling purposes.
- (v) Separate jack strip field/ audio patch panel for analog and digital inputs will be provided by the tenderer.

5.4 PEAK PROGRAMME METER:

The Programme level metering shall be with **Peak Programme Meter** (Bar graph Display or LEDs Type). This unit shall work independently in any configuration for signal monitoring without loading the source.

5.5 AMPLI-SPEAKER PANEL:

The Ampli-speaker with mounting arrangements shall have two ampli-speakers, one for each channel. The monitoring output will be fed to the ampli-speakers. The Ampli-speaker shall meet the following specifications:

S. No.	Technical Parameters	Technical Specification
(i)	Frequency range	63 Hz-15 kHz
(ii)	Audio Power	8 Watt Continuous for each channel
(iii)	Volume Control	adjustable for each channel
(iv)	Audio input	Balanced Stereo
(v)	Input Impedance	$\geq 10 \text{ k}\Omega$
(vi)	Power Supply	As per AIR specification clause 1.15

5.6 REPEAT COIL:

- (i) A Line to line audio transformer shall be provided for isolating balanced and unbalanced circuits.
- (ii) Hum reduction: The shielding and design of the windings shall be such that the hum level picked up by the unit, when placed in normal magnetic field inside equipment rack is better than -75dBm, as measured across either winding, both secondary and primary being terminated by 600Ω .
- (iii) Insertion Loss: Less than 1dB
- (iv) Frequency response: better than $\pm 1 \text{ dB}$ (30 Hz-15kHz) referred to 1 kHz.

5.7 RACK WIRING:

- (i) All the wiring in the rack shall be carried out with MIL standard approved PTFE insulated, shielded, twin core, audio cables of standard size in PVC cable duct.

- (ii) The wiring for all the equipment shall be routed through terminal blocks which shall be suitably located for easy accessibility. All the wiring on the terminal block shall be suitably marked. The wiring bunches shall be neatly laid and clamped to the body of the rack.
- (iii) Power supply wirings shall pass through separate conduits and shall be segregated suitably from the audio wiring in order to avoid noise and hum pick up.

5.8 DISTRIBUTION AMPLIFIERS:

The Analogue Stereo and Digital Audio Distribution Amplifier will be used for feeding analogue stereo and digital audio programme to various destinations.

Analogue Stereo Distribution Amplifier should be solid state audio amplifier having one stereo input and 4 separate individually adjustable stereo outputs.

The Digital Distribution Amplifier should be solid state having one digital input and 4 separate digital outputs.

(i) ANALOGUE STEREO DISTRIBUTION AMPLIFIER:

S. No.	Technical Parameters	Technical Specification
1.	Input Impedance	Input impedance shall be $\geq 10 \text{ k } \Omega$ (balanced)
2.	Input Level	
a.	Nominal	0 dBu
b.	Maximum	+20 dBu
3.	Gain	Shall have adjustable gain of $\pm 5 \text{ dB}$ with respect to nominal setting
4.	Output Level	
a.	Nominal	0 dBu
b.	Maximum	+20 dBu
5.	Output Impedance	Output impedance shall be $\leq 50 \text{ } \Omega$ (balanced)
6.	Frequency Response	$\pm 0.1 \text{ dB}$ in frequency range of 20 Hz to 20 kHz
7.	THD + N	Less than 0.1% at nominal level (1 kHz) and less than 0.5% at maximum output level. (Terminated into a load of 600 Ω) throughout the audio frequency range of 20 Hz to 20 kHz
8.	S/N Ratio at nominal Input/Output, rms unweighted (22 Hz-22kHz)	$\geq 90 \text{ dB}$
9.	Inter Output Loading:	
a.	If one of the outputs gets short circuited, the level on the rest of the outputs shall not fall by more than 0.3 dB.	
b.	If two of the outputs get short circuited, the level on each of the remaining outputs shall not fall by more than 0.6 dB.	
10.	Inter-Channel Phase Difference	Not more than 5° in frequency range of 125 Hz to 10 kHz and 10° from 20 Hz to 20 kHz
11.	Inter-Channel Level Difference	Within $\pm 0.5\text{dB}$, from 20 Hz to 20 kHz
12.	Inter-Channel Crosstalk	Equal to or better than 60 dB at 20 kHz at nominal level
13.	Input/Output Connectors	Input and all outputs shall be on 3-pin XLR connectors

(ii) DIGITAL DISTRIBUTION AMPLIFIER:

S. No.	Technical Parameters	Technical Specification
Digital Audio Input		
(i)	Configuration	AES/EBU standard, 24-bit resolution
(ii)	Sampling Rate	32, 44.1 or 48 kHz automatically selected
(iii)	Connector	XLR-type, female, EMI-suppressed
(iv)	Input reference level	Variable within the range of -20 to 0 dBFS
Digital Audio Output		
(i)	Configuration	AES/EBU standard, 24-bit resolution
(ii)	Sample Rate	32, 44.1 or 48 kHz, selected in software
(iii)	Connector	XLR-type, male, EMI-suppressed
(iv)	Impedance	110 Ω
(v)	Output reference level	Variable within the range of -20 to 0 dBFS

5.9 Other Accessories:

- (i) A LED lamp to illuminate when the door is opened shall be provided on one of the side at top.
- (ii) Arrangement may be made for mounting tag-blocks/terminal strips at a suitable height from the bottom at the rear side.
- (iii) PVC channels may be provided for routing cables.
- (iv) Necessary drawers shall be provided for keeping patch cords & headphones.
- (v) Suitable arrangement is to be made for mounting AIR Monogram on the top frame on the front side.
- (vi) Two 2U blank space shall be provided for fixing Satellite Receivers (Set Top Box).
- (vi) Blank panels of 1U height wherever required for proper gap between equipment are to be provided suitably.

5.10 Power Supply:

- (i) Mains Panel with indication lamp and MCB to distribute power supply for various equipments, mounted on front side bottom in the rack shall be provided.
- (ii) RFI Filter to protect against electrical & EM disturbances shall be provided for protection in the mains supply.
- (iii) Power supply to all the equipments/circuits in the rack shall be distributed from this Mains panel along the height of rack at each equipment level through 3 Pin 5A socket. The Rack shall also be provided with two additional sockets of 3 pin 5A.

5.11 Earthing:

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

5.12 Shielding:

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

5.13 The tenderer shall prepare schematic drawings & layout of equipments in the offered Rack and submit along with tender.

6.0 SECTION IV, E- SPECIFICATION FOR AUTOMATIC AUDIO CHANGEOVER SWITCH:

There will be two external sources of audio from the output of two Set Top Boxes (DTH)[**To be provided by AIR**]. The audio shall be fed to both the Transmitters via Distribution amplifier from one external source as selected by the Automatic Audio changeover switch.

Automatic audio changeover switch should be suitable for two stereo audio inputs and one stereo audio output for connecting audio from two sources. Selection of one of the audio input to output should be possible manually via front panel and remotely through SNMP over TCP/IP network. In case of failure of one of the audio source, silence detection should be possible and thereby automatic changeover to another audio source should be possible for which changeover time should be adjustable from 5 sec to 90 second. The automatic audio changeover switch shall provide negligible attenuation and shall not cause any deterioration of audio input signal made available at the output. MIB file will be provided by tenderer.

Technical Parameters of Automatic Audio Changeover Switch shall meet following specifications:

S. No.	Technical Parameters	Technical Specification
(i)	Input Mode	Stereo, Mono
(ii)	Silence wait time	Adjustable from 5 sec to 90 sec
(iii)	Working mode	Automatic, Manual, Remote control through SNMP over TCP/IP network
(iv)	Output audio mode	Stereo, Mono
(v)	Analog Input-1	2 × XLR female
(vi)	Analog Input-2	2 × XLR female
(vii)	Analog Output	2 × XLR male
(viii)	Ethernet Port/Web Server	For remote control through SNMP over TCP/IP network.
(ix)	Power Supply	As per AIR specification clause 1.15.

SECTION IV, F – SAMPLE TECHNICAL SPECIFICATION OF FM MONO & STEREO MOD MONITOR WITH RF AMPLIFIER (Not a part of supply with this tender and will be provided by AIR)

2.1 The FM Mono and Stereo Modulation Monitor should provide a complete solution for the analog portions of the FM signal. It should combine the features and functions of an RF Amplifier, FM Demodulator, Stereo Demodulator, RDS decoder, SCA decoder etc. in one stand-alone unit.

S. NO.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
2.2	R.F. INPUT:	
2.2.1	Frequency Range	88 MHz-108 MHz [To be tunable to any frequency in VHF FM band 88 MHz to 108 MHz]
2.2.2	RF Input Range	1 to 5 Vrms, 50 Ω BNC Connector
2.2.3	Antenna Input	100 μ V or better sensitivity, 75 Ω
2.2.4	Accuracy at all Modulation Levels	\pm 2.0 % or better
2.3	BASEBAND MEASUREMENTS:	
2.3.1	Modulation Frequency	30 Hz - 100 kHz
2.3.2	Frequency Deviation	\pm 75 kHz for 100% modulation.
2.3.3	Frequency Deviation Indication	0 to 133 %
2.3.4	Frequency Deviation Indication Accuracy	\pm 2.0 % or better
2.3.5	AM Noise Measurement	To measure AM noise down to 70 dB from 100% AM modulation.
2.4	MPX Signal Output:	
2.4.1	Frequency Response	Better than \pm 0.25 dB
2.4.2	Total Harmonic Distortion plus Noise (THD+N)	Not more than 0.01%
2.4.3	IMD (SMPTE) (60 Hz/7 kHz, 4:1)	Not more than 0.02%
2.4.4	Signal to Noise Ratio	\geq 90 dB
2.5	STEREO MEASUREMENTS:	
	It should have 2 modulation meters for simultaneous monitoring of L & R channels, total modulation and measurements of channel separation, crosstalk, S.C. suppression, noise and pilot etc. It should be possible to feed in MPX signal separately.	
2.5.1	Channel Separation (L/R or R/L) (30 Hz to 15 kHz)	Better than 70 dB
2.5.2	Crosstalk (L+R) to (L-R) or (L-R) to (L+R)	Better than 65 dB
2.5.3	Pilot Carrier Measurement	0 % to 15 % injection
2.6	OUTPUT:	
2.6.1	Level (L & R)	\geq 0 dBm, 600 Ω , balanced
2.6.2	Frequency Response	Better than \pm 0.25 dB
2.6.3	De-emphasis	50 μ sec.
2.6.4	Signal to Noise Ratio	\geq 85 dB
2.6.5	Total Harmonic Distortion plus Noise (THD+N)	Not more than 0.01%
2.6.6	Inter Modulation Distortion (SMPTE) (60 Hz/7 kHz, 4:1)	Not more than 0.02%
2.7	POWER REQUIREMENTS	Single Phase as per Section-I
2.8	GENERAL REQUIREMENTS:	
2.8.1	Instrument should be suitable for mounting in a standard 19" rack.	
2.8.2	All RF input and power input cords with suitable connectors are to be provided.	
2.8.3	All accessories needed for various measurements to be quoted.	
2.9	ENVIRONMENTAL CONDITIONS (As per Section -I)	

SECTION IV, G - TECHNICAL SPECIFICATION OF STEREO FM DIGITAL AUDIO BROADCAST PROCESSOR

2.1 SALIENT FEATURES:

- a. The specification for Stereo FM Digital Audio Broadcast Processor is meant for broadcast purpose in the audio chain of VHF FM transmitters.
- b. It should have Digital Signal Processing technique.
- c. It should be able to provide multi band (minimum 5) compression, limiting and clipping, automatic wideband gain control.
- d. It should have phase limiter to maximize audible transparency. It should also have provision for stereo enhancement and high/low frequency enhancement.
- e. It should have in-built feature of multiple user and system configuration pre-sets. The user audio pre-sets and system configuration pre-sets should be stored in the memory and without any battery backup. By using the processor user pre-set, the factory pre-set of the Processor should not change.
- f. The equipment shall be capable for continuous operation to ensure the uninterrupted broadcast without degradation in performance.
- g. The equipment should have system audio bypass functionality with adjustable gain setting to completely defeat the processing for test and alignment.

2.2 The Stereo FM Digital Audio Broadcast Processor should accept following inputs.

2.2.1 AES/EBU inputs

2.2.2 Analog left-right inputs

2.2.3 Sub-carrier inputs (Subsidiary Channel Authorization and Radio Data System/Radio Broadcast Data System i.e. SCA and RDS/RBDS)

2.3 The Stereo FM Digital Audio Broadcast Processor should give following outputs.

2.3.1 AES/EBU output

2.3.2 Analog left-right output

2.3.3 Two Composite stereo output/ multiplexed output with individual level control. These outputs will be ITU-R BS 412 compliant as per sub-clause 2.5.1 under clause 2.5 (Technical conditions) of section 2.0 of Rec. ITU-R BS 412-9.

2.3.4 Pilot tone output for synchronization of external devices etc.

2.4 Necessary function switches such as level/gain control etc. should be available on the front panel. All these control shall be rugged and reliable.

2.5 The Stereo FM Digital Audio Broadcast Processor should have visual monitoring and real time level monitoring of various technical parameters on the front panel and a compact one unit for ease of operation.

2.6 It should be capable for remote control operation and should be SNMP compliant. It should have visual monitoring of various technical parameters remotely through PC etc. The tenderer will also provide MIB file.

2.7 Radio Frequency Interference (RFI)/Electromagnetic Interface (EMI) filter shall be provided at mains input of the Stereo FM Digital Audio Broadcast Processor as per relevant provisions of standards for effective rejection of the interference from the high power FM/AM transmitters operating in the premises.

TECHNICAL SPECIFICATIONS:

S. No.	TECHNICAL PARAMETERS	TECHNICAL SPECIFICATIONS
2.8	ANALOG AUDIO INPUT	
2.8.1	Configuration	Stereo
2.8.2	Nominal Input Level	Software adjustable from -4.0 to +12.0 dBu.
2.8.3	Maximum Input Level	+24 dBu
2.8.4	Connectors	Two XLR-type, female, EMI-suppressed.
2.8.5	A/D Conversion	Minimum 24-bit
2.8.6	Input Impedance	$\geq 10 \text{ k } \Omega$
2.9	ANALOG AUDIO OUTPUT	
2.9.1	Configuration	Stereo. Flat or pre-emphasized (at 50 μ s), software-selectable.
2.9.2	Output Level (100% peak modulation)	Adjustable from -4 dBu to +20 dBu peak, into 600 Ω or greater load, software-adjustable.
2.9.3	Signal to Noise Ratio (referenced to 100% modulation, 20 Hz to 15 kHz)	$\geq 80 \text{ dB unweighted}$
2.9.4	Total Harmonic Distortion plus Noise (THD+N) (20 Hz to 15 kHz)	$\leq 0.02 \%$
2.9.5	L/R Cross Talk (20 Hz to 15 kHz)	$\geq 70 \text{ dB}$
2.9.6	Connectors	Two XLR-type, male, EMI-suppressed.
2.9.7	D/A Conversion	Minimum 24-bit
2.9.8	Frequency response (20 Hz to 15 kHz)	$\pm 0.5 \text{ dB}$
2.9.9	Output Impedance	$< 50 \text{ } \Omega$
2.10	DIGITAL AUDIO INPUT	
2.10.1	Configuration	Stereo, AES/EBU standard, 24-bit resolution.
2.10.2	Sampling Rate	32 kHz /44.1 kHz, 48kHz automatically selected.
2.10.3	Connector	XLR-type, female, EMI-suppressed, 110 Ω
2.10.4	Input Reference Level	Variable within the range of -25 dBFS to -10 dBFS
2.11	DIGITAL AUDIO OUTPUT	
2.11.1	Configuration	Stereo, AES/EBU standard
2.11.2	Sample Rate	32 kHz /44.1 kHz, 48kHz selected in software
2.11.3	Connectors	XLR-type, male, EMI-suppressed
2.11.4	Output Level (100% peak modulation)	-20 dBFS to 0 dBFS, software-controlled.
2.11.5	De-emphasis	50 μ s Software-selectable
2.12	COMPOSITE BASEBAND OUTPUT	
2.12.1	Configuration	Two outputs with independent level control.
2.12.2	Maximum Output Level	+12 dBu
2.12.3	D/A Conversion	Minimum 24-bit
2.12.4	Signal to Noise Ratio (referenced to 100% modulation, 20 Hz to 15 kHz)	$\geq 85 \text{ dB unweighted}$
2.12.5	Total Harmonic Distortion plus Noise (THD+N) (20 Hz to 15 kHz)	$\leq 0.02\%$
2.12.6	Stereo Separation at 100% modulation (30 Hz to 15 kHz)	$\geq 55 \text{ dB}$
2.12.7	Cross talk Linear (main channel to sub-channel or sub-channel to main channel) referenced to 100% modulation	Better than 70 dB

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2.12.8	38 kHz Suppression	≥ 70 dB (referenced to 100% modulation)
2.12.9	Pilot Protection	60 dB relative to 9% pilot injection, ± 250 Hz
2.12.10	Pilot Stability	19 kHz, ± 1.0 Hz
2.12.11	Pilot level	Adjustable from 6% to 12%, software controlled
2.12.12	57 kHz (RDS/RBDS)Protection	≥ 50 dB relative to 4% sub-carrier injection, ± 2.0 kHz
2.12.13	Connectors	Two BNC, EMI suppressed.
2.13	REMOTE CONTROL INTERFACE	
2.13.1	Configuration	Four inputs & two outputs, opto-isolated and floating
2.13.2	Voltage	AC or DC. Details to be given by tenderer
2.13.3	Connector	Suitable for 2.14.1(EMI suppressed)
2.13.4	Control	User-programmable for multiple user presets, factory presets, bypass, test tone, stereo or mono modes, analog input, digital input.
2.14	REMOTE COMPUTER INTERFACE	
2.14.1	Configuration	TCP/IP via direct cable connect, modem or Ethernet interface.
2.14.2	Connectors	RS-232(EMI-suppressed), Ethernet
2.15	POWER	
2.15.1	Voltage	AC Single phase, 230V ± 10 %, 50Hz ± 4 %
2.15.2	Connector	IEC (EMI suppressed). Detachable 3-wire power cord to be supplied.
2.15.3	Safety Standards	ETL listed to UL standards, CE marked.
2.16	ENVIRONMENTAL CONDITIONS	As per Section -1.0
2.17	Dimensions (Approximate) (W \times H \times D)	To be fitted in 19" rack
2.18	The Stereo FM Digital Audio Broadcast Processor shall essentially have the following:	
(i) Protection against current over-loads:	The equipment should mute in case of overload and revert to normal functioning once overload ceases to exist.	
(ii) Protection against RF:	The equipment is to be provided with adequate interference shielding so as to perform satisfactory operation in the transmitter hall, without degradation in performance, which houses other high power FM/AM transmitters.	
2.19	The equipment should have protection against open circuit, short circuit, ultrasonic frequencies and high RF fields.	
2.20	An earth terminal shall be provided in the equipment body for connecting audio earth connection.	
2.21	ACCESSORIES: All necessary accessories like connection cords and connectors shall be supplied along with the units. The standard accessories should be clearly mentioned in the tender. Also, optional accessories, if considered useful/recommended by the supplier, should be quoted separately with technical details.	

SECTION IV, H - TECHNICAL SPECIFICATION OF 2-BAY VHF FM ANTENNA SYSTEM

1. One No. 2-Bay vertically polarized (Pole Type) VHF Antenna along with mounting arrangement shall be supplied with each set.
2. The Antenna will be mounted on the top of the foldable pneumatic/ electro-mechanical tower.
3. Following documents shall be supplied along with the Tender:
 - a. VSWR and Return loss curve for complete Frequency range.
 - b. Horizontal Radiation Pattern. c. Vertical Radiation Pattern
4. Brief Specifications of the Antenna to be supplied are given below:

S. No.	Parameters	Specifications
1.	Operating Frequency Range	88 MHz -108 MHz
2.	Impedance	50 Ω unbalanced
3.	VSWR	Better than 1.2: 1 over 5 MHz from 100 MHz to 105 MHz and to be optimized to 1.1: 1 for operating frequency (to be intimated later at the time of placement of order)
4.	Power Handling Capacity (Total)	≥ 7.5 kW
5.	Polarization	Vertical
6.	Gain w.r.t. Half Wave Dipole	≥ 4.5 dBd
7.	Lightning Protection	All metal parts to be DC grounded.
8.	Branch feeder cables and Clamps for mounting Dipoles	Suitable Branch feeder cable fitted with 7/8" EIA connector at both ends and Clamps to be supplied with the Antenna.
9.	Input Connector of main power divider of antenna system	1-5/8" connector suitable for connecting 1-5/8" RF Coaxial foam dielectric cable fitted with 1-5/8" EIA Connector.
10.	Output Connectors of main power divider of antenna system	7/8" EIA connector
11.	Input Connector of dipoles	7/8" EIA connector
12.	Mounting of Antenna	All the required hardware for mounting of the antenna including Antenna Supporting Interface on which the antenna will be mounted shall be supplied along with the Antenna system.
13.	Maximum Wind Speed	198 km/Hour
14.	Ambient Temperature	-25°C to 40 °C
15.	Humidity	95% non-condensing
16.	Rainfall	Moderate to heavy
17.	External material of Dipoles and rigid feed lines	Exterior of dipoles will be made of stainless steel or Marine Brass. Rigid lines with Marine Brass or Copper.
18.	Internal material (for Dipoles, Power Divider, Rigid lines & interconnecting feed cables/ lines)	Inner lines of Dipoles will be of Copper, Brass & those of Power Dividers will be of copper or Brass. All electrical contacts will be silver plated. All inners and bullets of connecting head or mating head will be made of Beryllium copper and silver plated. Insulators will be made of virgin Teflon.
19.	Maximum Wind Speed	198 km/Hour
20.	Dead load (Approx.)	100 Kg including mounting hardware
21.	Wind loading (Approx.)	250 Kg

Suitable arrangement for keeping antenna system during transportation shall be made on the tower trolley.

SECTION IV, I - TECHNICAL SPECIFICATION OF RF COAXIAL (FOAM TYPE) CABLE

1. The RF Coaxial (foam type) Cable for feeding to Antenna with suitable connectors shall be supplied with each transmitter. The Transmitter shall be connected to the Antenna via RF Coaxial (foam type) Cable.
2. The cable shall be complete with end connectors, hoisting grips and cable clamps for its hoisting.

S. No.	Technical parameter	Technical specification
1.	Type of RF Coaxial Cable	Foam Dielectric Coaxial Cable
2.	Size	1-5/8"
3.	Average Power Rating of RF Foam Dielectric Coaxial Cable at standard conditions VSWR 1.0, ambient temperature 40° C @ 108 MHz)	≥ 12 kW
4.	Attenuation of RF Foam Dielectric Coaxial Cable at standard conditions VSWR 1.0, ambient temperature 20° C @ 108 MHz in dB/100 M)	≤ 0.80
5.	Frequency Range	88 MHz-108 MHz
6.	Impedance	50 Ohm ± 1 Ohm
7.	Material for Inner Conductor	Corrugated Copper Tube
8.	Material for Outer Conductor	Corrugated copper
9.	Weight of Cable	To be given by the tenderer.

The RF Coaxial foam type Cable shall be as per AIR Specification, failing which, tender will be considered incomplete and is liable to be rejected. The RF Coaxial foam type Cable shall be supplied with 1-5/8" EIA flange fitted at both end of the cable with Bullets (inners) for 1-5/8" Flange Connectors complete for each places.

All following accessories associated with RF Coaxial Cables are to be provided:

- (i).Hoisting stockings
 - (ii).Earthing kits
 - (iii).Wall gland
 - (iv).Cable Clamps (adjustable height) with nut, bolt & washer and associated accessories
- Any other accessories offered for the completeness of the system (Item wise details & part No., if any, of the offered and included materials are to be given by the tenderer)
- (v) **Suitable arrangement of cable drum for housing the cable along with arrangement for reeling of cable as and when required during transportation shall be provided on the tower trolley.**

SECTION IV, J- TECHNICAL SPECIFICATION OF THE FOLDABLE PNEUMATIC/ELECTRO-MECHANICAL TOWER

1. INTRODUCTION:

Pneumatic/ electro-mechanical foldable tower of 30 M high alongwith suitable mobile trolley are required to be supplied, for mounting of 2- bay side mount vertically polarized VHF FM antenna.

The Body of the trolley shall be built on 4 Wheel Base (minimum Size 16inch × 7.5inch) and shall have approx. suggestive size of 6000mm (L) × 2400mm (W) × 2200mm (H). The actual size of the mobile trolley for foldable Tower should be as per O&M and regulatory requirements as per applicable standards/ IS and complete details shall be submitted by the tenderer in the tender document. Four Nos. of integrated stabilizer jack stand for trolley shall be supplied by the Tenderer. The capacity of the jack shall be 6 tons each suitable for hilly terrain.

The tower shall be self-supporting type having square section base out of galvanized steel sections/structures of four legs. The foldable tower and antenna system should be mounted in such a way so as to maintain the balance of mobile trolley. The pneumatic/ electro-mechanical tower in the rest position shall be lengthwise along the trolley just to keep within road limits. This is essential requirement. Vertical rest position shall not be acceptable and offer is liable to be rejected. The trolley shall have sufficient space for carryout VHF FM antenna and RF Coaxial cable during transportation.

1.1 SCOPE:

This specification aims at design, fabrication & supply of 30 M high pneumatic/ electro-mechanical foldable tower Self Supporting Lattice Steel tower with trolley to support 2-Bay VHF FM antenna.

The broad scope of the present tender includes the following:-

- a. Preparation and submission of design documents & design drawings of Tower structure approved by any IIT/SERC alongwith certificate from IIT/SERC testifying the soundness and safety of design of tower structure to AIR (in hard & soft copies).
- b. Preparation and submission of general arrangement drawing(s) showing all the facilities and requirements as specified in the specification to AIR (in hard & soft copies).
- c. Preparation and submission of working structural drawings and submitting to AIR (in hard & soft copies).
- d. Construction of Trolley. Provision for keeping RF cable drum and Antenna during transit shall be made on the trolley.
- e. Design, Fabrication & Supply of tower structure and tower appurtenances/accessories including antenna apertures, Vertical Cable tray, pipe for mounting of FM antenna etc.
- f. Painting of the tower structure.
- g. Providing protection against lightning, earthing of tower, Aviation Obstruction Lights (AOL) including Beacon light and sun-switch. The aviation obstruction lighting arrangement shall be as per latest International Civil Aviation Organization Recommendations. The details of Power Supply arrangements for aviation obstruction lights shall be provided with the tender. Distribution of supply to Aviation Obstruction Lights shall be through suitable weatherproof junction boxes with suitable mounting.
- h. The power supply cable for multi-point power sockets will also be supplied by the tenderer.
- i. The cables for AOL and utility outlets at various platforms shall be taken on tower on the vertical cable rack.
- j. Hauling up of 2-Bay VHF FM antenna and RF Feeder cable.
- k. Joint inspection with representative(s) of the firm and AIR.
- l. Joint inspection of pending works as pointed out during joint inspection with representative(s) of the firm and AIR.

- m. Inspection and certification for structural firmness, verticality and all other design specifications by any IIT/SERC **after erection of tower** and submission of inspection report & certificate(s) (in hard & soft copies) to AIR.
- n. Handing over of tower with completion report (in soft & hard copies) including **videography & photographs** showing complete tower.
- o. Any other work necessary to complete the job.

2. GENERAL:

The specifications indicated herein are only to guide the tenderer about the requirements of the user. Detailed design of the tower from all aspects should be got worked out by the tenderer, keeping in view the effects of local meteorological conditions like wind velocity, seismological & environmental conditions, temperature, local provisions and as per good engineering practice to ensure the safety of the tower.

- a. The tower shall be designed considering probability factor based on mean probable Design life of tower structure as 100 years.
- b. The tenderer shall obtain Wind Zones data as per IS: 875 amended to date and seismic zone data as per IS: 1893 amended to date. The above data only shall be used in the Design Calculations. However, it may be kept in view that the wind map and seismic map are approximate only and require a judicious decision on the part of the designer to provide a good design of the tower for a design life of 100 years.
- c. It may also be ensured by the tenderer that if the site falls within a short distance from another wind zone having a higher basic wind speed, the tower shall be designed as per the higher basic wind speed.
- d. The design of the tower shall be based on recognized principles of structural design Engineering, conforming to latest IS codes and Standard Engineering Practices. **Full responsibility regarding soundness of design including factor of safety and the execution of work rests with the tenderer.**
For limit state of strength, partial safety factor for loads under worst atmospheric conditions and critical loadings shall be considered as a minimum 1.5 on any destabilizing load (including but not limited to, wind loads). If dead load contributes to the reduction of stresses or supports the stability for any particular action, suitable expected dead loads shall be considered.
- e. The overall force co-efficient for wind load on tower shall be taken from IS: 875 amended to date. For calculating the solidity ratio, actual obstruction area of tower shall be considered.
- f. The permissible stresses in the various structural members of tower shall be adopted from the relevant clauses of IS: 800 amended to date.
- g. Loading effect of seismic forces as per IS: 1893 amended to date and cyclonic winds and conditions of frost etc., if any, is also be taken into consideration.
- h. Loading effect due to antenna and various accessories shall be taken into consideration.**
- i. The successful tenderer shall indemnify and hold harmless the purchaser against claims in respect of injury/any mishap to any person, howsoever arising from erection of the tower, and in the course of such work and throughout the period during which the safety of the tower is guaranteed.
- j. The successful tenderer shall fully discharge all obligations under the Indian Workmen's Compensation Act, any local, State laws and regulations in so far as it affects the workmen in his employment.

3. INFORMATION TO BE SUPPLIED WITH TENDER DOCUMENTS:

The tenderer must furnish the following documents/information with the tender to assess the full merit of the offer, failing which the tender shall be considered incomplete and is liable to be rejected. This is mandatory requirement.

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- a. (i) The general arrangement drawing(s) showing all the facilities and requirements as specified in the specification should be attached with the offer.
(ii) Outline drawings to scale showing the assembly of the structures. These drawings should show the main dimensions including the size of main structural members, mounting centres, methods of attachment to foundations and any special features of design or form.
(iii) Total weight of tower shall be given.
- b. Detailed information concerning design parameters such as loads due to wind effect & seismic effect, dead loads, antenna loads, combination loads considered, design philosophy along with other information which shall contain the following:
 - (i) Wind speed, terrain category, topographic factor, gust factor, risk factor etc.
 - (ii) Seismic zone factor, importance factor, response reduction factor etc.
 - (iii) Antenna loads due to 2- Bay antenna, Power divider, RF Cable etc.
 - (iv) Load combinations considered.
- c. The design calculations indicating the various formulas used for design, the bearing and shear stresses used for the design of bolted sections and the factors of safety adopted for the various structural components and materials. For limit state of strength, partial safety factor for loads under worst atmospheric conditions and critical loadings shall be considered as a minimum 1.5 on any destabilizing load (including but not limited to, wind loads). If dead load contributes to the reduction of stresses or supports the stability for any particular action, suitable expected dead loads shall be considered.
- d. Typical design load calculation with methodology due to seismic effect.
- e. Details of Bill of Materials (BOM) showing Grade Designation and Quality of steel members, weight of the tower structure, details of fasteners, nuts, washers etc.
- f. Design forces compression/tension due to critical load combination, design of main members panel wise i.e. leg, bracing (diagonal & horizontal) with section adopted, capacity of members based on length, slenderness ratio, allowable stress with reference & formula.
- g. Deflection at top of tower and reaction at base in most critical load combinations.
- h. Complete printed technical literature/technical data sheet/schematic drawings/detailed information of LED based Aviation Obstruction Light and details of Antenna Fixtures, paint materials, earthing etc.
- i. Details of past experience as defined in eligibility criteria.

4. INFORMATION TO BE SUPPLIED AFTER ISSUE OF ACCEPTANCE OF TENDER:

The successful tenderer shall furnish the following documents/information within 15 days after issue of acceptance of tender: (Hard copies along with soft copies in pen drives)

- (i) Submission of general arrangement drawing(s) showing all the facilities and requirements as specified in the specification to AIR Directorate. (in hard & soft copies) -2 Sets
- (ii) Submission of design documents & design drawings of tower structure approved by any IIT/SERC alongwith certificate from IIT/SERC testifying the soundness and safety of design of tower structure to AIR Directorate. (in hard & soft copies) -2 Sets
- (iii) Detailed working structural drawings (in hard & soft copies) -2 Sets
- (iv) Any other drawings for the completeness of the tower design as per AIR specification.

The following references shall be indicated in the above design documents & design drawings, working structural drawings, general arrangement drawings etc. while submitting to AIR Directorate

- (1) AIR AT No. (2) AIR Specification No. & (3) Approval of competent authority with signature & stamp.

5. PRE-DISPATCH INSPECTION OF TOWER:

Pre-dispatch inspection of tower material & erected tower shall have to be got done by representative(s) of All India Radio in India by giving an advance notice of **TWO WEEKS**. The certifying agency IIT/SERC that will issue certification for structural safety & firmness, verticality and all other design specifications in compliance of AIR specification will also be part of PDI of tower. Pre-dispatch inspection of tower material and subsequent inspection of erected tower shall be done as per mutually accepted test procedure, which shall be submitted and got approved from All India Radio before the supply of tower.

The recommendations/suggestions during PDI will have to be incorporated by the tenderer before submitting final completion report. All costs on this inspection and post inspection corrections, if required, for completeness of the tower shall be borne by the tenderer. However, expenses for AIR's representative(s) will be borne by AIR.

Successful tenderer will also give the complete working demonstration of tower with Antenna System and RF Feeder cable etc.

6. SUB- SECTION (TECHNICAL SPECIFICATIONS)

A) TECHNICAL FEATURES:

The pneumatic/ electro-mechanical tower should have following technical features:

- a) Extending the tower
- b) Lowering the tower

B) Tower to be designed for the following parameters.

- (i) Nested height: less than 6M
- (ii) Extended height: 30 M
- (iii) Type of mounting: External support bracket
- (iv) Number of sections: As per design
(the inner top section will be with the provision for mounting antenna system)
- (v) Material: Structural steel conforming to IS:2062 amended to date
- (vi) Base plate: As per design
- (vii) Weight of tower: As per design
- (viii) Wind speed: 198Kmph
- (ix) Loading due to Antenna system & cable:
Approx. 150 Kg Dead Weight & 300 Kg wind load @ 198kmph

7. VERTICALITY TOLERANCE, DEFLECTION, TWIST & SWAY:

A. UNDER STILL AIR CONDITIONS:

The tower shall be vertical after erection and no straining shall be permitted to achieve this. The verticality of tower shall be within the provisions of Table-1(III) (b) of IS: 12843:1989 amended to date, viz. $\pm H/1000$ or ± 20 mm (whichever is less) for towers up to 30 M height i.e. the bottom of the line joining to the centre of the top of the tower and the centre of the base of the tower shall be within this limit. (H refers to the height of the tower).

B. UNDER MAXIMUM WIND LOAD CONDITIONS:

- (i) The horizontal deflection of the vertical axis of tower shall not be more than 1° (degree) at various levels including top, under maximum wind and other critical loading conditions. The deflection at top of tower shall be checked as per the provision made in latest IS:800: 2007. The reaction at base shall be unfactored.
- (ii) The angular twist shall not exceed 0.5 degree.
- (iii) The sway shall not exceed 0.5 degree.

The self-supporting foldable tower shall be supported with guy ropes/wires (if required) to maintain the above criteria. The guy ropes/wires should be detachable and easy to use.

8. PROTECTION AGAINST LIGHTNING:

The tower shall be provided with a suitably designed complete system of lightning protection in accordance with provision of IS: 2309 (amended to date). Copper strip of size **50 mm × 3 mm** is to be provided for Lightning Arrester from top of the tower to the ground along.

9. PAINTING:

The details regarding painting of tower are given below:-

The tower shall be given one coat of ETCH primer (2 Pack) followed by two coats of Zinc Chromate primer and two or more coats of synthetic enamel paint. The tower shall be painted to have equal alternate bands of international orange and white colours with top and bottom bands painted in orange as per latest International Civil Aviation Organisation Recommendations.

The paints used in painting shall be in accordance with IS: 2074, IS: 2932 & IS: 2933 amended to date. Etch primer shall conform to IS: 5666 amended to date and Priming of Zinc Chromate shall conform to IS: 104 amended to date.

Painting shall be done in accordance with IS: 1477 Part I & II amended to date.

The minimum dry film thickness shall be 8 microns of ETCH primer, 40 microns of each coat of Zinc Chromate primer and 40 microns of each coat of synthetic enamel paint. The overall Dry Film Thickness (DFT) should not be less than 168 microns.

10. EARTHING:

The foldable tower base plate should be doubled earthed. *The earth resistance of the tower earthing should be as per IS.*

SECTION IV, K- TECHNICAL SPECIFICATION OF POWER SUPPLY SYSTEM

1. TECHNICAL SPECIFICATION OF UNINTERRUPTED POWER SUPPLY SYSTEM (UPS)

General

The input power to the transmitter system is supplied from an external 400 V, three phase system. One no. of 20 kVA On-line UPS are to be provided to maintain power to the selected transmitter and other equipments. 20kVA UPS shall conform to the following Specifications.

ESSENTIAL FEATURES:

1. (a) The system should be fully DSP controlled in all respects (i.e. rectifier control, inverter control, display, digital diagnostics), solid-state type, utilizing true On-Line Double Conversion technology (high frequency PWM using IGBT Rectifier & inverter section)
(b) The system should be capable of providing continuous high quality sinusoidal waveform power for electronic equipment loads.
(c) The system should conform to voltage frequency independent technology.
2. The DSP based controller should have following characteristics:
 1. Diagnostic monitoring achieved by Fast Fourier Transform (FFT) of spectrum analysis
 2. Adaptive control by having the speed to monitor and control the system concurrently
 3. Real time generation of smooth, near optimal reference profiles and move trajectories
 4. Control power switching and inverters and generate high resolution outputs
3. The UPS should offer low input Total Harmonic Distortion (THDi), good regulation, excellent transient response and high stability.
4. (a) The system should have a monitoring panel (LCD Based) with various types of fault alarms and metering functions including:
 - i. Output voltage, current & frequency.
 - ii. Input voltage, current & frequency.
 - iii. Bypass Voltage, Current & frequency.
 - iv. Battery capacity, backup time left & bad battery indication.
 - v. Temperature of System, Inverter section and Rectifier section.
(b) The UPS system should display both RMS value and Peak value of load current.
(c) The UPS system should have facility to generate aural alarm for bad Battery condition.
5. (a) The system should have wide input voltage and input frequency tolerance as specified in Rectifier section.
(b) Transient Voltage Surge Suppressor (TVSS) should be provided at the input & output of the UPS System.
6. The system should have provision for controlling all the three phases individually, even in case of 100% unbalancing at the output with even 0% load on one phase. There should be no change in regulation in phase voltage with 100% unbalancing.
7. The system should be capable of supplying energy to load from commercial mains without any break in case of phase reversal at the input. It should also generate aural and visual alarm in such a case.

8. a) The system should have provision of protection for
 - (i) Input under voltage
 - (ii) Input Over Voltage
 - (iii) Output Over Voltage
 - (iv) Output Over load
 - (v) Output short circuit
 - (vi) Battery under Voltage
 - (vii) Over temperature
 - (viii) DC Over currentb) The system should generate aural and visual alarms for above-mentioned conditions.
9. The system should have Controls as
 - (i) Input Circuit Breaker
 - (ii) Bypass Circuit Breaker
 - (iii) Maintenance Bypass Switch
 - (iv) Inverter ON / OFF Switch
 - (v) Alarm acknowledge switch
10. (a) The system should have facility to store the Logs of the events being monitored by monitoring system.
(b) The UPS system should have the capability to store a minimum of last 100 events.
(c) The UPS should have in-built digital fault diagnostic through stored events in UPS system.
11. The system should also include an external 35 kVA Isolation Transformer alongwith the UPS to provide protection from electrical surges/noise (inherent and generated both) present in the input power supply.
12. The firm should specify the Nos. & type of desired batteries, which shall be part of the system to be offered. **[The batteries of known & reputed world-class manufacturer only will be accepted]. The sealed maintenance free-batteries AGM-VRLA type shall only be acceptable. The detailed technical specification of batteries with their working life is also to be specified and provided with the offer.**
13. A- The battery charger should have provision of
 - (i) Monitoring battery temperature and accordingly adjusting the charging level to enhance the battery life.
 - (ii) Programmable battery charging which can be programmed to enhance battery life.B- Battery charging current should be adjustable from 10% to 80% through Microprocessor & displayed.
C- For battery sizing calculation, temperature is required to be taken as 0°C.
14. The system should have communication port RS-232 and should be compatible to integrate with NMS (Network Management System). Suitable software for monitoring & diagnostics etc. should be supplied.
15. The system should be designed with scientific forced air-cooling for proper ventilation. Acoustic noise level should be kept at minimum.

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16. The UPS system output should be isolated from the DC circuit of the UPS.
17. The firm should specify the total area requirement for installation of the system including batteries. A floor layout plan should be attached.
18. The system that shall be quoted against this tender should include all switchgears, cables, earthing etc. Terminals for input 3-phase, 4 Wire, power supply & output power supply should be provided.
Power supply sub distribution in the output is not in the scope of this tender. A block-schematic diagram with all items should be provided.
19. The system that shall be quoted against this tender should be capable of running continuously round the clock, seven days a week without interruption or failure.
20. The UPS System quoted must conform to the latest international standards of safety and EMC. The conformance to such standards (indicating standard's name & number) must be stated in compliance statement. A certificate issued to OEM by authorized international/ national agencies should be submitted along-with the declaration from OEM in this regard. In general, following standards should be met: -
 - A. Safety: IEC 62040-1 / EN 50091-1
 - B. Emission and Immunity: IEC 62040-2, Class A / EN 50091-2 (Class A)
 - C. Performance: IEC 62040 –3/ EN 50091 – 3
 - D. CE-Marked in accordance with EEC directives 73/23 “low voltage” and 89/336 “electromagnetic compatibility”
21. The UPS manufacturer must be ISO 9001-2000 certified company. A copy of the certificate should be enclosed with the offer.

Section-3.0

TECHNICAL SPECIFICATIONS:

A. SYSTEM

1. Technology:

The UPS shall be designed to operate as **true on-line, double conversion fully DSP controlled type UPS** strictly as per the definition of IEC 62040-3 as follows:

a) Normal Operation:

The UPS inverter should continuously supply the critical AC load. The rectifier & charger should take power from the AC input source, convert it to suitable DC and supply to the inverter as well as charge the Batteries on Automatic Float cum Boost Mode.

b) Upon Mains Failure:

Upon failure of AC input power, the critical AC load should continue to be supplied by the inverter, which should obtain power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the AC input source (Mains/ DG).

c) Upon Mains Restoration:

Upon restoration of AC input power, the Rectifier/Charger should automatically restart walk-in and gradually take-over the supply to inverter and charging to the battery.

d) Static Bypass:

UPS Module should have inbuilt 100% rated static Bypass Line.

All the loads should be transferred to the Static Bypass Line of the UPS without any break for the following conditions:

- i. If the UPS fails
- ii. If overload beyond 150% for 1 minute is faced by the UPS
- iii. If UPS sense over temperature (i.e. inverter exceeding 65°C simultaneously).
- iv. If the UPS inverter is put-off

2. MTBF of the System:

Bidder to specify and justify MTBF of the system

3. Capacity:

20 kVA at power factor 0.8

B. RECTIFIER SECTION

1. (a) Technology

Fully DSP Controlled IGBT based Rectifier with input filters to reduce the harmonics.

2. Input

3-phase, 4-wire plus Ground

3. Input Voltage

320 to 460 V (at full load)

4. Input Frequency

47 – 53 Hz

5. Input Power factor

> 0.96

6. Input Total Harmonic Distortion (THDi)

≤ 4%

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- 7. Soft start (0-100%) > 10 Sec
- 8. DC ripple voltage < 1%

C. INVERTER:

- 1. **Technology** **Fully DSP based IGBT/PWM Inverter**
- 2. Output Voltage
 - 1. Nominal: 3-phase, 4-wire plus Ground
 - 2. Static stability: 380V- 415V AC (adjustable), 50Hz
- 3. Output voltage regulation:
 - a) 100% Balanced load < $\pm 1\%$
 - b) 100% Unbalanced load $\pm 2\%$
 - c) Transient response (100% step loading) < 5%
 - d) Recovery time to steady state (< 5 msec.
($\pm 1\%$)
- 4. Output frequency regulation
 - a) Line Connection: $\pm 1\%$ (meeting input frequency range of 47-53 Hz.)
 - b) Self Connection: $\pm 0.05\%$
- 5. Overall Efficiency: >90% (for all loads from 50% to 100%)
(From AC I/P to O/P of the U.P.S. system)
- 6. Output voltage Distortion: < 1% linear load &
(at rated load) < 4% non-linear load with **3:1 crest factor**
- 7. Audible noise level at 1 metre Less than 60 dBA
- 8. Overload capacity:
 - (a) Inverter
 - Upto 125% 10 min
 - Upto 150% 1 min
 - (b) Bypass Mode
 - Continuously upto 135% of rated current
 - 135% to 170% of rated current for 1 min
 - > 170% of rated current for 2 seconds
- 9. RF Suppressions: As per BIS & EMC standard (up to date)
- 10. Computer Interface: RS 232 Interface
- 11. Online Battery testing: Required
- 12. (a) Mains failure,
(b) Battery Low,
(c) UPS Fault Tenderer to provide Audio/Visual alarm at remote location (maximum distance 100 meter) in addition to local.

D. BATTERY BANK & BATTERY

- | | | |
|-----|--|--|
| 1. | Battery Bank Capacity | Minimum 35,000 VAh |
| 2. | Nominal output current capacity | Minimum 42 Ah |
| 3. | No. of Battery String | 1 Set complete |
| 4. | DC Voltage of the battery bank | Should be Minimum 480 V |
| 5. | Type: | 12 V Batteries of Sealed Maintenance Free (AGM-VRLA).
(Please submit the catalogue of offered battery with its detailed specifications along with the charging & discharging characteristics and Graphs from the OEM). |
| 6. | Backup time: | Minimum 15 minutes (at the End of Life (EOL) of Battery) for 100 % load with each UPS system |
| 7. | Charging Voltage | Float: 13.5±0.1 V per Battery at 27°C
Boost: 13.8±0.1 V per Battery at 27°C |
| 8. | Cutoff Voltage | 1.70-1.75 V per Cell (should be Selectable) |
| 9. | Floating Voltage regulation between no load & full load. | 1% or better. |
| 10. | Codes & Standards | The supplying battery manufacturer shall be ISO 9001/14001 certified. The battery design shall be of field proven technology. The manufacturer shall have 5 years of field experience. Copy of Certificate for 'AGM-VRLA Battery' must be attached with the offer. |
| 11. | Design | All batteries within the battery string shall be of the same manufacturer and model. |
| 12. | Life | 10 years designed life at 27°C on full float. |
| 13. | Life Cycling Characteristics | Each battery shall be designed to provide 4000 cycles at 20% depth of discharge (DOD) at 27°C and 1200 cycles at 80% DOD at 27°C. |
| 14. | Deep Discharge | Following an equalization charge, battery shall be capable of being recharged to rated capacity from a discharge down to zero volt per cell. |
| 15. | Recharge Rate | The battery shall be capable of a 90% recharge within 12 hours. |
| 16. | Operating Temperatures and altitude | The battery shall be capable of operating in temperatures ranging from -10°C to +40°C. Battery shall withstand hard freezing without damage to the alloy, plates, or cell container assembly. The battery shall be capable of operating at a maximum of 4500 M from ground level |

(AMSL).

- | | |
|---|--|
| 17. Gassing | No special ventilation shall be required under normal operating conditions. No separate “battery room” shall be required to house the battery unit. |
| 18. Battery Orientation | Battery bank shall have clear removable covers to facilitate visual inspections and allow ease of service. |
| 19. Self-Discharge | The battery shall have a maximum self-discharge rate of 0.5-1.0% per week at 27°C. |
| 20. Construction/
Functional Description | <p>Pressure Relief Valve</p> <p>Each battery shall have a self re-sealing pressure regulation valve, which operates at specified pressure. A flame arrester shall be incorporated in the valve designed to diffuse the Hydrogen gas escaped during charge and discharge. The valve shall be such that it cannot be opened without a proper tool. The valve shall be capable to withstand internal battery pressure specified by the manufacturer.</p> |
| 21. Housing | The Battery system should be installed & supplied with MS Racks. |
| 22. Product Identification Label | Each battery shall have a self-adhering label identifying the product manufacturer, model and nominal Amp-Hour capacity. The label must be readily visible from the front of the battery. The label shall not wear out throughout the life of the battery. |
| 23. Capacity Testing | Each battery shall be capacity tested at the manufacturing facility as per standard battery testing procedure. |
| 24. Leak Detection | Integrity of the container and post seals shall be verified in the battery manufacturing process using an automated helium leak detection process. |
| 25. Seismic Requirements | Batteries shall be packaged in steel modules that meet Seismic requirements when stacked horizontally. |
| 26. Accessories | <p>Each battery shall be furnished with the following accessories:</p> <ol style="list-style-type: none">1. Each battery system shall include the necessary inter-battery and inter-module connectors and terminal plates. The connectors shall be lead-tin plated copper and shall include stainless steel hardware.2. One set of numerals (one numeral per battery) suitable for permanent attachment to batteries. |

3. Assembly and connection drawings.
4. Each module shall include an easily removable transparent “snap on” safety shield to cover all connectors

27. Recycling services

The manufacturer must provide worldwide recycling services to properly dispose of spent lead-acid batteries. These services must include proper instructions for the packaging, transportation, and beneficial recycling as required meeting E.P.A. guidelines (or other applicable agencies) for the safe handling of lead-acid batteries. Documentation of disposal must be provided.

28. Max. Battery Charging current with nominal load

To be specified
(Battery charging current should be selectable from the front panel of UPS system upto maximum value)

29. The bidder should submit battery sizing calculation justifying following points:

- No. of Batteries
- Capacity of Battery (Ah), (By considering the K-factor, efficiency of the system, Temperature correction factor, Ageing correction factor, etc.)
- DC bus voltage

The total required area for battery installation should also be mentioned and shall be suitably integrated/installed in the Power Supply Container.

E.ISOLATION TRANSFORMER

The Isolation Transformer should be three phase, naturally air cooled type, housed in one steel cubical provided with cast iron wheels at bottom and should have hooks for lifting the unit. The cubical enclosing the Isolation Transformer should have sufficient openings (doors and removable covers) for ease of operation and maintenance of the system.

- | | |
|--------------------------------|--|
| 1. AC Input: | Delta 3-phase, 400±10% (phase to phase) |
| 2. AC output: | Star 3-phase, 400±10% (phase to phase)
230 (phase to neutral) |
| 3. Frequency: | 47 to 53 Hz |
| 4. Capacity: | 35 kVA |
| 5. Duty cycle and use | 24×7 Continuous, Indoor |
| 6. Common Mode Noise Rejection | Better than 110 dB |
| 7. Inter winding capacitance | Less than 0.005 pF |
| 8. Insulation resistance | More than 500 Mega Ω at 500V |
| 9. Terminals | Studs on fiber glass plate at rear |
| 10. Cable entry | Bottom |

F. ENVIRONMENTAL CONDITION

- | | |
|--|----------------|
| 1. Operating Ambient Temperature | 0°C to 40°C |
| 2. Storage/Transport Ambient Temperature | - 25°C to 40°C |
| 3. Relative Humidity | 95% |

2. TECHNICAL SPECIFICATION OF SILENT TYPE DIESEL GENERATOR SET WITH AUTOMATIC MAINS FAILURE (AMF) PANEL

1. Scope:

This specification is for Supply, Installation, Testing and Commissioning of a Silent type 30 kVA capacity (at Site conditions) Three phase, 50 Hz, 240 volt AC, air-cooled Diesel Generator set with brush-less excitation for FM transmitters and associated equipments. The (DG set) will be provided with suitable acoustic enclosure with trolley for indoor/outdoor location in tropical climate. The schedule of requirement is given which should be read with this specification.

1.2 **Location:**

The Stand alone, Self Contained in weather proof canopy Silent type Air cooled, DG set with trolley will be installed in container as per CPWD specifications.

1.3 **General Conditions:**

1.3.1 The DG Set should generally conform to the technical specifications in Section – II.

1.3.2 The DG Set should be designed for efficient and trouble free service for 24x7 hrs. of continuous operation at a stretch. All materials used in the manufacture should conform to the IS: 10002-1981 and 13364(Part-2)-1992 amended to date.

1.3.3 All work should be carried out in accordance with standard mechanical & electrical practice. The units should be designed for ease in operation, maintenance and complete safety to operating personnel.

1.3.4 Only easily available standard components should be used as far as possible. The tenderer should submit an undertaking to make available spares and replacement parts for a period of ten years.

1.4 The electrical earthing of the machine shall be done in accordance with provision of IS-3043: 1987 amended to date.

1.5 Special conditions to be fulfilled:

DG set to be supplied shall be fitted with heavy duty silencer to attenuate audio frequency noise from exhaust. It should be as per Central Pollution Control Board norms.

1.6 **Tenderer shall provide heating system for subzero temperature.**

1.7 **Completeness of contract:**

All fittings and accessories which may not have been specifically mentioned or which the tenderer may not explicitly mention in his tender but are necessary for the satisfactory operation of the DG Set should be deemed to be included in the contract and is to be provided by the contractor without any extra charge.

1.8 **Documents to be submitted with tender.**

The tenderer should submit following documents along with tender offer, **failing which the tenders are liable to be rejected.**

- a. Printed original leaflets with illustrations of DG set Components viz. Engine, Alternator, ventilation systems, Control Panel and Acoustic canopy.
- b. Experience certificate in manufacturing/ assembling of 30 kVA silent type, Air Cooled DG Set for above capacity in their own name during the last five years. A list of such works giving details of capacity & date of supply along with the completion certificates issued by the client deptt.
- c. A valid copy of ISO 9001: 2000 Certificate of OEM/OEA of the offered DG set (Engine and Alternator).

- d. Test certificate of similar type and capacity of Engine and Alternator.
- e. List of standard tools as part of DG set required for the maintenance of the DG set.
- f. Supply of fuel consumption data at different loading of the alternator, i.e. No load, 25%, 50%, 75%, Full load and permissible over load.
- g. Total weight and base plate details and dimensions are to be provided.
- h. Construction details of acoustic enclosure.

1.10 Documents to be submitted After Acceptance of Tender:

- 1.10.1 One set of installation, assembly at site, operation, maintenance and trouble shooting manual having details of routine, preventive/ corrective and periodical maintenance to be supplied **within 15 days** to DDG (E-FM), P&D Unit, DG: AIR, New Delhi in Hard and soft copies in Pen drive.
- 1.10.2 Following documents/details will have to be supplied to the consignee along with the DG Set at the time of delivery:
 - a) Two hard copies of the book of instructions for the Installation, Testing, Commissioning, Operation and Maintenance of DG Set.
 - b) Factory Test Certificates showing the results of tests actually conducted on the Engine, Alternator & Accessories.
 - c) Two sets of finalized drawings showing dimensions and other fixtures on the DG Set including wiring of panel.

1.11 PACKING:

The packing/installation in the Container should be suitable to withstand transportation hazards.

1.12 GUARANTEE:

As per clause 1.11 under Section-I.

1.13 TESTING/ACCEPTANCE AT SITE:

The supplier should show all the required tests at site as per mutually agreed acceptance procedure according to relevant standard of BIS for such jobs at no load, partial load and full load (in steps of 25% from no load to full load and permissible overload). The consumable items like fuel, lubricants, belts etc. during this testing should be arranged by the tenderer.

- 1.13.1 Tenderer should arrange at site the load for testing at no load, partial load and full load (in steps of 25% from no load to full load) and for over capacity test as per Section II.

- 1.14 **CLEARANCE:** The supplier should have to arrange clearance from CEA (if applicable) for DG set before the same is offered for acceptance to AIR at site.

SECTION-II

2. TECHNICAL SPECIFICATIONS

The stand alone, silent type, Air cooled, DG set mounted on a self contained rust proof chassis complete with weather proof, sound proof Acoustic enclosure with built in exhaust & ventilation system. DG Set should meet the noise level. All units & accessories should be housed on single chassis inside the enclosure.

2.1 ALTERNATOR: The Alternator will conform to IS: 13364 (Part-2)-1992 or amended to date for manufacturing, Enclosure of alternator as per IS: 4691 IP 23 or amended to date, mounting as per IS: 2253 or amended to date & testing of Alternator as per relevant IS with latest amendments.

I.	ALTERNATOR	REMARKS
1.	Electrical output (continuous) in kVA	30 kVA at site condition
2.	No. of phases and in case of poly-phase machines, inter-connection between the phases if any.	Three phase with neutral star connected.
3.	Rated voltage	415 Volts (Nominal)
4.	Power factor	0.8 (nominal) lagging
5.	Frequency in Hz	50 Hz
6.	Direction of rotation	Clock wise looking from driving end.
7.	Speed in RPM	1500
8.	Type of enclosure of alternator	Screen protected drip proof.
9.	Type of coupling direct or by belt	Engine is to be coupled directly to alternator. Chain or belt drive is not acceptable.
10.	Exciter(self or separate)	i) The alternator shall be self regulating and shall have its own brushless exciter and rated for continuous operation from no load to full load under all working conditions. ii) The alternator shall be able to supply unbalance load as specified in IS 13364 Part-II: 1992 or amended to date.
11.	Type	Rotating field, salient pole brushless alternator complying to IS 4722:1992 or amended to date
12.	Class of Insulation	Rotor Class 'F' stator Class 'B' or better
13.	Voltage regulation	Shall be within $\pm 2.5\%$ from no load to full load.
14.	Neutral point	The neutral point is to be brought to the terminal block and earthed as per I.E. rules/IS code.
15.	Cooling	Self ventilated forced air cooling.
16.	Bearing	Anti-friction grease lubricated ball/roller bearing
17.	Temperature rise	As per IS 4722:1992 or amended to date
18.	Overload capacity	10% overload for one hour in every 12 hours.
19.	Occasional excess current for AC generator	Shall be capable of with standing a current equal to 1.5 times the rated current for not less than 30 seconds.
20.	Voltage frequency measurement	Display through separate meters.
21.	Vibration	As per IS 12075:1987 or amended to date
22.	Noise	As per IS 12065:1987 or amended to date
23.	i) Terminal ii) Output Terminals iii) Terminal marking	Three phase with Neutral The alternator output terminal shall be mounted in a suitable box. As per IS 4728:1975 or amended to date
24.	Whether rated output is required at NTP or site condition	At site condition taking into accurate de-rating factor as per IS:1601 or amended to date

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II.	DIESEL ENGINE:	
1.	Type of engine & fuel to be used	i) High Speed Diesel, air cooled conforming to IS 10002 and IS 10000/80 Part VII with amendment 1&2 or BS-5514. The fuel pump should be block type. ii) Electric start, 4 stroke, 3 or more cylinder diesel engine designed to run continuously at 1500 RPM complete with all the standard accessories.
2.	Method of starting	The engine shall be cold starting type
i)	Hand starting, battery starting or compressed air starting	Electric starting from 12 volt lead storage battery with facility of remote operation. Manual starting facility is also to be provided. DC voltmeter DC ammeter shall be provided for starting battery. DG Set offered with compressed air starting will not be accepted.
ii)	Battery	Yes, battery offered should be of good quality and reputed make given in section II-4 of suitable capacity.
3.	Capacity of fuel tank in liters required	Service Tank of minimum 65 liters capacity with suitable dial type fuel gauge. (NB: Tank should be part of self-contained cabinet & housed suitably.)
4.	Speed of engine directly coupled	1500 RPM with class 'A' governing as laid down in IS 10000/BS-5514 or amended to date.
5.	Engine protection equipment	i) The engine shall be totally enclosed type and preferably be fitted with positive pressure system of lubrication to the moving parts. No moving part shall require lubrication by hand either prior to the starting of engine or while it is in operation. ii) Lubricating oil filter shall be provided for operation under normal conditions for engine for a period of 500 hours without the necessity of replacement or cleaning.
6.	Instrument's required for the engine	i) Lubricating oil pressure gauge. ii) Battery charging ammeter.
7.	Site conditions a) Max. ambient temperature b) Relative Humidity c) Altitude above mean sea level in meters	-25° C to + 40° C 95 percent, non condensing. 4500M
8.	Whether rated output required at N.T.P. (as per IS-10000/BS-5374) or at site conditions	At site conditions
9.	Type of mounting:	The DG set shall be mounted on specially designed heavy MS channel base (provided common bed for engine alternator coupled together) from a regular foundation in MS container. The foundation details will be supplied by the supplier of the equipment. The DG set will be mounted on cushy foot mounting so as to absorb vibrations.
III.	Control and Exciter panel:	
1.	Type of panel and type of mounting	Indoor type floor mounted, dust proof front door. All

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		components shall have labels fixed on the panel. The control panel shall be completely assembled, wired up and connected for ready installation. The panel shall have required switches/circuit breakers of suitable rating aluminium bus bar, CTs, neutral link, earthing bolt, power and control terminals, indicating lamp, instrument fuses and various protections as mentioned in the subsequent clause 2 to 7.
2.	Type of switch and protection etc., and other arrangements (to be provided, if not the inbuilt features of DG Set System).	<ul style="list-style-type: none"> i) Moulded case circuit breaker (MCCB) as per IS with over load and short circuit protection of a rating suitable for capacity of DG set. ii) One set of fuses shall be provided for instruments and control circuit. iii) Earth fault protection through relay. iv) Under voltage protection through relay. v) Under frequency protection through relay vi) The control panel will also be completed with internal wiring and labeling.
3.	Local/remote start	<p>The local/remote starting facility shall have following features:</p> <ul style="list-style-type: none"> a) Start/stop push button for local starting b) Special switch on local control panel providing locking in any of the four positions. 1. Local, 2. Remote, 3. Off 4. Test. c) A timer shall be provided to ensure that the starter is not pressed for too long at a time. d) A pressure switches to ensure that the starting motor is not energized, when the generator is running. This can be operated from the oil tube pressure.
4.	Ammeter	
a)	Whether one for each phase or only one with rotary switch	One with selector switch to select the phase current.
b)	Size of scale	The ammeter scale shall not be less than 5A above the full load current.
c)	Type of movement	Moving iron type (Ferro magnetic)
d)	Accuracy	Industrial grade 'A' as per relevant specification
e)	Whether flush or projected pattern	Flush
5.	Voltmeter (R-Y-B)	One number with selector switch (0-500 V)
6.	Indicating lamp	Three numbers (Flush mounted) in different colour, with fuses
7.	Frequency meter & hour meter	To be provided
8	Multifunction Meter (p.f., kW, kVAR, kVA)	To be provided
9.	Tools	A standard set of tools like Double ended spanner set, Screw Driver set, fuel gauge, 'O' ring ,push rod etc. required for daily maintenance purposes should be provided.

IV Automatic Mains Failure (AMF) Control Panel:

The Diesel Generator will be provided with an Automatic Mains Failure (AMF) Control Panel.

General Features: The control panel shall be fabricated out of 1.6 mm sheet steel, totally enclosed, dust, damp and vermin proof free standing floor mounted type & front operated. It shall be made into sections such that as far as feasible, there is no mixing of control, power, DC & AC functions in the same section and they are sufficiently segregated except where their bunching is necessary. Hinged doors shall be provided preferably double leaf for access for routine inspection from the rear. There is no objection to have single leaf hinged door in the front, all indication lamps, instruments meter etc. shall be flushed in the front. The degree of protection required will be IP-42 conforming to IS: 2147

Terminal blocks and wiring: Terminal blocks of robust type and generally not less than 15 Amps capacity, 250/500 volts grade for DC up to 100 volts and 660/1100 volts grade for AC and rest of the junction shall be employed in such a manner so that they are freely accessible for maintenance. All control and small wiring from unit to unit inside the panel shall also be done with not less than 2.5 sq. mm copper conductor, PTFE insulated and 660/1100 volts grade. Suitable colour coding can be adopted. Wiring system shall be neatly formed and run preferably, function wise and as far as feasible segregated voltage-wise. All ends shall be identified with ferrules at the ends.

Labeling: All internal components shall be provided with suitable identification labels suitably engraved. Label shall be fixed on buttons, indication lamps etc.

Equipment requirements: The control cubical shall incorporate into assembly of general equipment and system as under.

- a) Microprocessor based relay with composite meter for digital display of
 - i. Generator voltage/AC Mains voltage
 - ii. Generator current.
 - iii. Power Factor
 - iv. Frequency
 - v. Energy
 - vi. Three attempts engine start/engine cranking relay.
 - vii. On-delay timer for load change over
 - viii. On-delay timer for engine shut off
- b) Mode selector switch for setting the panel on any one position such as OFF or AUTO or MANUAL or TEST.
- c) Engine on-off switch (Push button type)
- d) MCCB of suitable rating shall be provided.
- e) Rectangular aluminum/copper bus bars (one number for each phase, neutral and Earthing terminal) of adequate ratings duly colour coded with heat shrinkable PVC sleeves.

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- f) Contractors of suitable rating (for DG sets & AC mains) with over load relay.
- g) Under-voltage relay for mains.
- h) Battery charger complete with voltage regulator, float or booster selector switch, on-off switch, voltmeter and ammeter for charging the battery from mains. This will be in addition to the battery charging alternator fitted on the engine.
- i) Instrument & control Fuses.
- j) Five numbers indicating lamps to indicate 'mains ON', 'load on mains', 'set running', 'load on set' and 'battery charger on'.
- k) Any other switch, instrument, relay or contractor etc. essential for smooth and trouble free functioning of DG set with AMF panel. (To be specified by the tenders in their offer with complete detail of the item).

System Operation: The above-mentioned facility provided shall afford the following operational requirements.

Auto Mode:

- a) A line voltage monitor shall monitor supply voltage on each phase. When the mains supply voltage fails completely or falls below set value (variable between 80 to 95% of the normal value) on any phase, the monitor module shall initiate start-up of diesel engine. To avoid initiation due to momentary disturbance, a time delay adjustment between 0 to 5 second shall be incorporated in start-up initiation.
- b) A three attempt starting facility shall be provided 6 second ON, 5 Seconds OFF, 6 second ON, 5 Seconds OFF, 6 second ON. If at the end of the third attempt, the engine does not start, it shall be locked out of start and a master timer shall be provided for this function. Suitable adjustment timers are to be incorporated which will make it feasible to vary independently ON-OFF setting period from 1-10 seconds. If alternator does not build up voltage after the first or second start as may be further starting will not be made until the starting facility is reset.
- c) Once the alternator has built up voltage, the alternator circuit breaker shall close connection the load to the alternator. The load is now supplied by the alternator.
- d) When the main supply is restored and is healthy as sensed by the line voltage monitor setting, both for under voltage unbalance, the system shall be monitored by a suitable timer which can be set between 1 minute to 10 minutes for the load to be transferred automatically to main supply.
- e) The diesel alternator set reverts to standby for next operation as per (a), (b) and (c) above.
- f) The AMF Panel should have the provision to switch over between DG Set & mains power supply.

Manual mode:

- a) In a manual mode, it shall be feasible to start-up the generator set by the operator on

pressing the start push button.

- b) Three attempts starting facility shall be operative for the start-up function.
- c) Alternator circuit breakers closing and trip operations shall also be through operator only by pressing the appropriate button on the panel and closure shall be feasible only after alternator has built up full voltage full voltage. If the load is already on 'mains, pressure on 'close' button shall be infective.
- d) Engine shut down, otherwise due to faults, shall be manual by pressing a 'stop' button

Test mode:

- a) When under 'test mode, pressing of 'test' button shall complete the startup sequence simulation and start the engine. The simulation will be that of mains failure. Sequence (a) and (b) shall be completed.
- b) Engine shall build up voltage but the set shall not take load by closing of alternator circuit breaker. When the load is on the mains, monitoring of performance for voltage/frequency etc. shall be feasible without supply to load.
- c) If during test mode, the power supply has failed, the load shall be automatically get transferred to alternator.
- d) Bringing the mode selector to auto position shall shut down the set as per sequence I (d) provided main supply is ON. If the mains supply is not available at the time, the alternator shall take load as in (c) above.

Engine shut down and alternator protection equipments: Shut down and protection system shall be integrated in the control panel.

V. Acoustic Enclosure (Canopy)

- a) The Diesel Generator and its control panel will be mounted in an acoustic enclosure (sound attenuated).
- b) The enclosure should provide noise reduction of DG set to a level as per Central Pollution Control Board norms.
- c) The acoustic enclosure should be weatherproof, strong and suitable for outdoor location also. It should be made out of 16 SWG CRCA sheet press bent to designed shape and provided with internal acoustic on all the five sides including door and roof.
- d) The insulation should be covered with tissue paper and perforated sheet.
- e) The wall and roof panel will comprise double wall CRCA press bent sheet outside and perforated CRCA sheet inside.
- f) The enclosure should be collapsible type for easy dismantling.
- g) The enclosure should also be provided with a lockable access door for convenient entry of operating and maintenance personnel and for removal of diesel generator for repairs as and when required.

3. TECHNICAL SPECIFICATION FOR POWER SUPPLY LT DISTRIBUTION BOARDS

1. General:

- a) This specification covers Design, Supply, Erection, Testing and Commissioning of Cubicle type sheet steel switch board suitable for AC three phase as per section I.
- b) The general power supply schematic and electrical arrangement are shown in the P/S schematic. The switch board will be installed indoors. It shall however be suitable for working under tropical conditions with ambient temperatures (0 to 40°C and with humidity going up to 95%).
- c) The switchboard shall be designed for efficient and trouble free service for long period of continuous operations. All materials used in the construction shall be of high quality and conform to the relevant IS specifications.
- d) All Electrical work shall be carried out in accordance with standard electrical practice. The units shall be designed for economical and compact accommodation of the necessary, MCCBs and MCBs, for easy maintenance and complete safety to operating personnel.
- e) The L.T. switch board shall be complete with interlocking arrangements, safety shutters wherever required, small wirings, earthing strips, digital meter, cable compression glands and all accessories for installation and normal service. The design and construction of the switch board and switch gear shall conform to relevant IS standard.
- f) The switchboard offered shall be capable of withstanding rigorous use and of resisting rough handling during transport. Adequate lifting facility shall be provided for the complete equipment.
- g) A surge protection system may also be provided for the power supply system.

2. DETAILED TECHNICAL SPECIFICATIONS;

- a) The LT Distribution board shall be suitable for working on three phase with earthed neutral supply system, and for general requirement shall be as per relevant IS standard.
- b) The LT Distribution board shall be indoor type, wall fixing compact metal clad totally enclosed and readily extendible. The markings and arrangement for switch gear and control gear shall conform to IS standard.
- c) The type of enclosure shall provide a degree of protection conforming to relevant IS standard. The LT Distribution board shall be provided with necessary molded case circuit breaker with thermal overload and magnetic release and with miniature circuit breakers.
- d) The cubicle type LT Distribution board shall have a fault withstanding capability as per relevant IS standard.

3. Constructional features:

- a) The LT Distribution board shall be designed for wall/ floor mounted. Incoming cables will enter the switch board vertically from the below. LT Distribution board shall be provided with removable bottom plates with cable compression glands fixed for aluminum/copper cables. Aluminum /copper crimping type lugs shall be provided to cables. Outgoing cables shall be taken from the top of the LT Distribution board.
- b) The LT Distribution board shall be of single front construction and equipments shall be mounted on the front only. The LT Distribution board shall have a uniform height & depth throughout its length. All cable connections shall be accessible from front side.
- c) The LT Distribution board shall present a flush appearance and shall be made of **2mm thick** (14 SWG) M.S. sheet and shall be free from rust, scales, grease and other foreign matters.
- d) For convenience of operation and ease of cable termination, there shall be adequate gap (minimum 500mm) between the floor level and the bottom most unit.

- e) The frame work shall be rigid and with modular arrangement. The frame work shall house the MCCBs/ MCB etc. in multi-tier formation. The equipments shall be mounted independent of the back plate and not on the rear surface of the housing.
- f) Each module shall be fitted with individual doors with concealed hinges. All doors shall be held securely against sponge rubber gaskets to make the equipment dust free and vermin proof.
- g) The compartment doors shall be so interlocked that it shall not be possible to open the door with the switch in ON position. Provision may also be made for pad locking the switches in off position wherever required.
- h) All steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphorescing, passivating and then be sprayed with a high corrosion resistant primer. The finishing treatment shall be by application of two coats of heat resistant synthetic enamel of approved shade as per relevant IS standard.
- i) A base channel, painted black shall be provided to prevent corrosion of sheet cubicles and to facilitate cleaning of floors.

4. BUS BARS

- a) Single piece, air insulated bus-bars of hard drawn high conductivity copper rated for the current indicated in the reference drawing and corrected for an ambient temperature of 0 to 40°C and conforming to relevant IS standard shall be provided.
- b) Bus bars shall be supported on unbreakable, non-hygroscopic supports rigidly held to the frame work of the chamber so as to withstand the dynamic forces during worst fault conditions. These are to be insulated individually with an approved non deteriorating insulating material to make it dust proof.
- c) The neutral bus bars should be insulated with provision for earthing at one point. Minimum clearances of bus bars between phase and neutral and between phase and earth shall conform to relevant IS Standard.
- d) The bus bars shall have continuous current rating throughout the length of the switch board. The neutral bus bar shall have continuous rating of at least 50% of the phase bus bar.
- e) Indicating lamp with protective fuse shall be provided on the bus bar chamber to indicate the status of the phase.

5. MOLDED CASE CIRCUIT BREAKERS (MCCB):

- a) The operating handle should clearly indicate ON, OFF and TRIP positions.
- b) Earth Leakage protection is to be provided with MCCBs for safety of operating personnel. All parts of the circuit breaker shall be enclosed in the molded housing with only the terminals accessible for external connections.
- c) The MCCBs shall be as per IS.
- d) Necessary interlocks wherever necessary to be provided.

6. MINIATURE CIRCUIT BREAKER (MCB):

- a) The MCBs shall be ISI marked.
- b) All the necessary Cable compression glands for the incoming/outgoing cables will be provided including connections etc. complete as required.

7. All control and metering wiring shall be done by 1.5 sq.mm (stranded) copper conductor, PVC insulated wire. CTs wiring shall be done with 2.5 sq.mm copper conductors (stranded). All control wirings shall be fitted with identification ferrule at each end duly numbered /identified. The wires shall be arranged and supported in such a manner that there shall be no strain on the terminations.

8. All the connection / interconnection inside the cubical type LT Distribution board shall be of copper conductor strip/solid circular bar/copper conductor (stranded)PVC insulated having rating at

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- least 1.5 times the normal rating. These are to be insulated individually with an approved non deteriorating insulating material to make it dust proof. As per the requirement, tenderer shall use suitable copper thimbles of suitable size duly crimped and fitted with nut bolt washer etc. in a neat, clean and in professional manner.
9. Digital Indicating Instruments: All the meters i.e. voltages, current, frequency, and power factor meter shall be digital meters and ISI marked. Current and potential transformer shall be as per relevant ISI standard. Metering shall be provided as per schematic. All the meters shall be digital and flush mounting type.
 10. Earthing: Earthing conductor shall be of aluminium and minimum size as 5 mm x 30mm. The terminals will be provided for connecting the board to external earth through 25 mm wide 3 mm thick copper strips.
 11. All the connections incoming/ outgoing cable shall be done as per the relevant IS standard along with the testing, commissioning of the LT Distribution board.
 12. Miscellaneous: In respect of following, the tenderer shall provide and comply in the SETC of the above LT Distribution board.
 - i) All the bus bar shall have colour identification.
 - ii) All the incoming / outgoing MCCBs, MCBs etc. are to be duly marked for proper identification.
 - iii) All the openings/holes in the LT Distribution board should be plugged / covered with the insulating sheet properly.
 - iv) All the tools required for the maintenance should be the part of the SETC of the LT Distribution board.
 - v) Suitable danger notice board with sign of skull and bones with voltage level indication and confirming to the relevant IS shall be affixed on the electrical installations.
 - vi) The glands of all the incoming/outgoing cables shall be connected with separate and distinct connections with earth.
 - vii) All the earthing strip wherever continuity breaks shall be got brazed / welded (as the case may be) in addition to their being tightened with nut and bolts.
 13. Two sets of spare fuses and lamps may also be included.
 14. **Complete schedule of materials of each unit, wiring diagram of the electrical circuit & exact dimensional details of the equipment offered, its weight, mounting arrangements and minimum clearance required from the floor is required to be submitted by the tenderer.**
 15. The trip settings of various breakers should be set at site after measuring the operating current values for best safety.
 16. The L.T. switch board shall be complete with interlocking **arrangements**.
 17. The LT Distribution board shall conforms to safety standards and offers high degree of protection to operating personnel as per relevant IS standard and Indian Electricity/CEA rules.
 18. Anti-corrosive primer and heat resistant synthetic enamel paints are to be used over the cubicle sheet.
 19. The LT Distribution board shall have been made dust free and vermin proof.
 20. The L.T. switch board shall have complete with interlocking **arrangements**.
 21. The LT Distribution board shall have conforms to safety standards and offers high degree of protection to operating personnel as per relevant IS standard and Indian Electricity/CEA rules.
 22. Earth Fault Relay with suitable range and Earth leakage current setting should be provided.

SECTION IV, L - TECHNICAL SPECIFICATION OF SETC OF VENTILATION EQUIPMENT AIR COOLED SPLIT AC (INVERTER TYPE)

1. General:

Air cooled split AC unit (Inverter type) [2 Nos. × 2.0 TR (Ton)] shall be provided for cooling transmitter and associated equipments/items in transmitter equipment container.

2. Technical specification:

S. No.	Technical description	Technical Parameter
i)	Cooling	2.0 TR(Ton) at 27°C
ii)	Cooling Capacity	6400W or above
iii)	Operating Voltage	Single Phase as per Section-I.
iv)	Power Consumption	Five star (Year 2020) for better efficiency
v)	Supply Air	550 CFM
vi)	Protections	Refrigerant High Pressure Refrigerant Low Pressure Cooling Thermostat Time Delay Relay Overload for Motors
vii)	Controls	(a) ON/Off (b) Cool (c) Ventilation (through independent fresh air fan)
viii)	Motor	The Motors should be as per IS Standard.
ix)	Wiring	All the Electrical Wiring shall be to PTFE and Conform to relevant IS Specification.
x)	Construction	The Sheet Metal Parts shall be made of heavy gauge steel sheet and painted. All the fasteners shall be of Stainless Steel to avoid corrosion.
xi)	Noise Level	The AC shall confirm to permissible noise level as per IS.
xii)	Air Filters	Synthetic fiber or wire mesh filters shall be provided on the inlets of evaporator coil and fresh air. The filters will be easy to remove and re-useable.

SECTION IV-M, GENERAL DESCRIPTION AND SILENT FEATURES OF MOBILE CONTAINERS

1. GENERAL SCOPE

This Specification lays down the requirements for body building of 2 Nos. of Mobile Containers. One for transmitter with associated equipments/items namely **Transmitter Equipment Container** and other one for Power supply system with associated equipments/items namely **Power Supply Container**.

The Body of each container with minimum suggestive size of 6000mm (L) × 2400mm (W) × 2200mm (H) shall build on minimum 4 wheel base (minimum Size 16inch × 7.5inch). The size of the mobile containers should be as per O&M and regulatory requirements as per applicable standards/ IS.

The containers shall be suitable for housed transmitter and all associated equipments/items as defined elsewhere in the specifications.

The system shall be designed to allow rapid transportation in the Indian hilly terrain, quick and easy deployment.

The installed equipment should have easy access to back panels for ease of maintenance. The layout & facility design should be done keeping in view broadcast and professional work flow needs for transmitter set up as per requirements as described in these specifications.

The layout should be designed to maximize the utilization of the available space without compromising the functional and safety requirements of transmitter station.

The equipments layout should be such that the containers should be balanced from all sides.

The containers shall have proper arrangement like cupboard etc. for storing/stacking spares.

The container should be aesthetically designed & air conditioning/ventilation according to the cooling load requirements.

The interior of the containers should be fitted with aesthetically designed & adequate quantity of compact LED light fittings to give proper illumination needed for operation and maintenance.

The Mobile Containers shall be a highly visible entity. Therefore, styling and aesthetics shall be characterised by modern trends and state of art towards enhancing the exterior and interior features of the Containers.

The fabrication, assembly and finishing work shall be carried out using proven engineering practices and use of tools, jigs and fixtures.

The tare weight of the container should not exceed 3000 Kg with Pay load capacity of minimum 10000Kg. **The design of the containers should be certify by approved structural stability agency for its stability for road transportation in hilly terrain area, tare weight and pay load capacity of the container.**

2. LAYOUT OF TWO CONTAINERS:

A brief detail of two Containers are given below.

2.1 Transmitter Equipment Container:

The Transmitter Equipment Container shall house the transmitters, associated equipments/items with all the control Panels for broadcast & monitoring etc. along with their equipment Racks. The tenderer is required to suitably place all the equipment Racks in the container in such a manner for ease of operation and maintenance.

Shelves with hinge doors and handles, knobs and locks are to be provided. This shall also have provision for locking. The drawer shall be made of suitable material.

Adequate Shock absorbers for mounting the equipment racks are to be provided by the tenderer. These shall provide adequate isolation for the delicate electronic equipments from the shocks and vibrations as encountered during transportation in hilly train area/road.

The main door of the transmitter equipment container shall provide a clear opening of 900mm (W) x 1950mm (H) to enable unhindered passage of equipment. The door shall be pivoted offset type. Three point snap lock shall be provided for the door. The door handles shall be elegant. Two Nos. of anodised Tower bolts should be provided on the inner side of the door alongwith internal lock arrangement.

Two steps mechanism each approximately 280mm (D) × 200mm (H) × 900mm (L) for access into the containers to be provided. The first step shall be at an approximate Height of 350mm from Ground. Rubber mats are to be provided on steps leading into containers, these shall be held in position by recesses or retainers on the steps.

A Foldable /hinged platform may be provided over the steps, to maximise the utilisation of floor space, during extended operating schedules in equipment room.

One window (approx. size 650mm × 400mm) with tinted toughened glass of minimum 4.8mm thickness in the container shall be provided. Window frame shall be of Aluminium. Suitable Channels shall be used to make the windows dust and waterproof. Holes shall be made in the window framework to ensure that rain water drains out wards and does not enter inside the containers. Provision shall also be made for window curtain.

One Air vent with exhaust fan and filter packing is to be provided on the right hand side of the transmitter equipment container for flushing out the stale air. Cut outs are also to be provided on the right hand side wall for ducting out the warm air. One inlet air vent with filter packing and inlet fans are to be provided on the left side of the transmitter equipment container. Provision is also to be provided to close the cut out ducts, if and when required.

One Chair is to be provided with 360 degree Swivel & Locking arrangement. Chair should be fixed to the Container base frame with requisite brackets and clamps at suitable place.

One work-table is to be provided with an auxiliary drawer for storing a laptop. During normal usage of the work-table, this will be in retracted position and locked. For laptop operation, the auxiliary drawer has to be pulled out and therefore auxiliary drawer shall to be on slides.

The transmitter equipment container shall have proper bedding arrangement for minimum two persons in tier along with lockers for operating/caretaking personnel.

2.2 Power Supply Container:

The Power Supply Container shall house the DG Set, UPS, Ladder and other accessories etc. Provision shall be made for supporting and anchoring these items on the base frame. The tenderer is required to suitably place all these items in the container in such a manner for ease of operation and maintenance.

Two number Head level storage space with two partitions in each with locking facility shall be provided in the Power Supply Container (Suggestive dimensions of one head level storage space: 1500mm (L) × 500mm (D) × 350mm (H).

Two Hinged doors of minimum width 1000mm each and minimum 1950mm height opening at the rear side for access to the Power Supply Container shall be provided. The doors shall be fitted with three point locking mechanism.

One personnel entry door shall be provided with a clear opening of 800mm (W) x 1950mm (H). The door shall be pivoted offset type with locking facility from inside & outside. The door handles shall be elegant. Two Nos. of anodised Tower bolts should be provided on the inner side of the door along-with internal lock arrangement.

Two steps mechanism each approximately 280mm (D) × 200mm (H) × 800mm (L) for access into the containers to be provided. The first step shall be at an approximate Height of 350mm from Ground. Rubber mats are to be provided on steps leading into containers, these shall be held in position by recesses or retainers on the steps.

One window (approx. size 650mm × 400mm) with tinted toughened glass of minimum 4.8mm thickness in the container shall be provided. Window frame shall be of Aluminium. Suitable Channels shall be used to make the windows dust and waterproof. Holes shall be made in the window framework to ensure that rain water drains out wards and does not enter inside the containers. Provision shall also be made for window curtain.

One inlet air vent to the Power Supply Container on the left side of the container and One exit air vent with blowers/ Exhaust fans on the right side to be provided. Provision is also to be provided to close these cut out ducts, if and when required.

An Exhaust pipe is also to be provided for the DG Set. This is required to be routed suitably by means of using minimum useful space of the container.

Adequate number of hooks is to be provided on the walls for hanging lightweight items and for latching loose articles. The points for latching shall be anchored rigidly to the super structure.

3. MAIN BODY CONSTRUCTION OF CONTAINERS:

i. *Base Frame*: Shall be made up of Steel channels and sections of adequate strength for the given pay load capacity (>10000Kg). Reinforcements shall be provided at locations for mounting equipment racks, DG Set, UPS, furniture and other accessories. Blind tapped holes shall be provided for fastening these items. The base frame shall be clamped on to the Chassis by High tensile U- Clamps. (M16 or Higher).

ii. *Super structure* is welded frame formed of hollow steel rectangular or square sections.

iii. *The roof structure* shall have appropriately located members for supporting and riveting. The roof structure shall be leak proof from rain/snow.

- iv. The body of each container shall be designed in such a manner that there must be adequate provision for air-lifting/lifting the entire container as and when required.
- v. The complete frame structure shall be fully pre-treated i.e. degreased, de-rusted and phosphating followed by one coat of metal primer and one coat of synthetic enamel grey.
- vi. The frontage of structure shall be symmetrical with respect to vertical and shall not be skewed. Suitable taper or curvature may be provided to enhance the styling.
- vii. Lightweight construction shall be used for bodybuilding. The tenderer shall extensively use weight reduction methods by way of using aluminium sections inside the container.

3.1 Flooring:

The flooring should be level within ± 5 mm and constructed using 19mm marine plywood with rubber spray on the lower side and 3mm vinyl flooring on the top. All joints and all corners shall be covered with aluminium flat/fluted strip to ensure that the flooring shall not peel off at any place. Alternatively, all joints could be hot air welded and the edges along the walls shall have aluminium beadings.

Clearance holes should be made in the wooden floor, panels and in the vinyl flooring at mounting points. Necessary tapped holes for mounting various equipments shall be provided. These should be on steel plates irrespective of whether the structure made of Aluminium or steel Sections. All tapings should have at least 10mm depth. The holes should be blind or sealed at the bottom, to avoid water ingress due to splashing.

3.2 Panelling:

Exterior Panelling: Stretch formed Aluminium Sheets of 1.6mm thickness and free of any waviness shall be used for any exterior panelling. The panels are to be welded to the structure. The roof outer panel shall be Aluminium. All joints in the roof shall have an insert of tar felt before riveting. Further, a strip of tar felt shall be pasted over all roof joints with suitable durable adhesives.

Provision should be made to drain off water from roof and all the doors and the entire containers should be rain/snow proof.

The Containers shall be subjected to heavy rain test for an hour and no leakage inside the containers is acceptable. It is suggested that extra care is taken in the design of bodywork to prevent entry of water and dust under extremes weather encountered in Indian conditions. **This test shall precede the inside panelling and is done in the presence of AIR representative.**

Interior panelling in **transmitter equipment container** should be done using suitable panels with carpeting bonded to panels. Joints if any should be finished with slim extruded & polished Aluminium beading with PVC inserts. Aluminium chequered panels may be used for a height of 6" from floor.

Anti drumming compounds (two coats) should be applied on inner face of panels before riveting.

3.3 Insulation for walls & floors:

PE foam sheets (40mm thick) shall be used for thermal and acoustic insulation between the outer and inner panels of the body. Two layers of 20mm thick (25 Kg. Per cubic meter density) shall be used with joints in the two layers being laterally displaced to avoid straight joints. PE foam must be packed tightly to avoid air gaps. 3mm PE insulation should be used before riveting panels on to structural members. As the inner panel drapes down to the floor, the Cable trays are to be located in the gaps so formed.

3.4 Hatch Panels:

The flaps and the hatch panels on the exterior panels shall be leak proof and be lined with moulded rubber gaskets. These should lock with snap action and have flush type locking arrangements. Hinged panels should be lined. Gas spring type retainers should be provided.

4. ELECTRICAL:

The equipment works on three phase supply. AC, DC & Signal cables shall be separately bunched and routed. These shall be supported on cable trays and secured by cable ties.

- a) The wiring for equipments shall conform to IS.
- b) The electrical circuitry of external and internal lamps and controls is to be done by the tenderer. Copper wiring of appropriate gauge and PVC insulation shall be used as per IS specification.
- c) Lamps: The Following lamps with fittings are to be provided.

Four LED lamps in transmitter equipment container.

Four LED lamps in power supply container.

Lamps to indicate the extremities of the containers.

Two spotlights with dimmer switches to be provided over the work-table.

Two search lights (100W each) are to be fixed on roof top (rear). The fixing arrangement for the searchlights shall have pan and tilt facility and One Lamp to light up rear side of the racks.

5. TRUCK TRAILER STABILIZER JACK STAND:

Four Nos. of integrated stabilizer jack stand for each container base shall be supplied by the tenderer. The capacity of the jack shall be 6 tons each suitable for hilly terrain.

In extended condition this shall lift the container off the ground by a minimum of 50mm (with tyres under fully inflated condition).

6. AIR-CONDITIONING:

The requirement of Air conditioning in Transmitter Equipment Container is estimated to be about 4 TR (2x2TR). However, it is required to be indicated by the tenderer as per, the calculation of the heat load of the transmitter and container keeping in view the tropical climate of India for use anywhere and give the full design of the A/C system for the container. Proper ventilation arrangement shall be provided during non-operational period of AC units. The mounting of air-conditioning equipment should be such that it should not cause any hindrance to parking and transportation of container.

Air conditioning system will be installed by the tenderer in transmitter Equipment Container along with necessary mounting provisions, cut outs for ducting and installation including fitment of A/C system during intermediate stages of the body building work. Any modifications in the body or special features that may be necessary for optimization of the a/c system performance shall be provided. The preferably space for outdoor units shall be kept in the rear side of the container.

7. PAINTING & COLOUR SCHEME:

Paint as per IS to be applied for exterior finish. A Minimum of two coats of paint is to be applied.

8. FIRE EXTINGUISHERS/OTHER ACCESSORIES:

Dry powder type fire extinguishers with 90% concentration of Mono Ammonium Phosphate (6kg × 2 Nos.) as per IS with wall mounting brackets shall be provided by the tenderer in both the Containers (in total 6kg ×

4 Nos.). The working life of the fire extinguishers should not be less than six years. Tenderer should provide standard/ mandatory fittings like mudguards, trailer hooks, front toe hooks, first aid box, etc.

9. LADDER:

One detachable aluminium ladder of very good quality with a loading capacity of minimum 100Kg. shall be supplied for access to the rooftop of the containers. Hooking/ anchoring arrangements for the ladder shall be provided on the roof at the rear as well as on the left side of each container.

During transit the ladder is to be firmly secured in the Power supply container. Provision shall be made for the same in the power supply container.

10. RAIN TEST:

After the completion of the bodybuilding, the containers shall be subjected to a heavy rain test for one hour. No leakage shall be permissible.

SECTION IV-N, EARTHING SYSTEM OF THE COMPLETE SETUP:

a. All the equipment i.e. transmitters and associated equipments/items installed in the **transmitter equipment container** shall be properly earthed individually through two nos. of separate braided copper wires each of size 25mm with copper lugs etc. and shall be brought out on suitable terminals for connecting client's earth.

b. All the equipment like DG Set, UPS, LT Panels etc. installed in the **Power Supply container** shall be properly earthed individually through two nos. of separate braided copper wires each of size 25mm with copper lugs etc. and shall be brought out on suitable terminals for connecting client's earth. Separate & distinct earth for the neutral & the body for DG set shall be provided. The body earth may be common with Container body. However, neutral earthing will be separate.

c. Provision of Earthing terminals for both the container's metal body for connecting client's earth shall be provided at two distinct appropriate locations in both the containers as per standard practice.

SECTION V (A): SCHEDULE OF REQUIREMENTS / MATERIALS (UN PRICED) FOR DSITC OF ONE SET OF CONTAINERISED 5kW MOBILE FM TRANSMITTER & ASSOCIATED EQUIPMENTS/ITEMS) {The tenderer must quote all items}

S. No.	Description	Make	Model	Qty.
	A. Supply:			
1.	(i) Supply of 5 kW Digital Compatible (HD & DRM+) VHF FM Solid-state MOSFET technology based broadcast transmitter in (1+1) configuration complete as per AIR Specification.			1 Set Complete
	(ii) Supply of Automatic changeover unit for 5 kW Digital Compatible VHF FM solid state MOSFET technology based broadcast Transmitter in (1+1) configuration complete with all accessories as per specification.			1 Set Complete
	(iii) Supply of Software & Hardware items required for Remote Monitoring & Control facilities as per AIR specifications			1 Set Complete
2.	Supply of laptop for Remote Monitoring & Control facilities complete as per AIR specifications (COTS item)			1 Set Complete
3.	Supply of complete installation material as given below such as RF Coaxial rigid lines, elbows, couplings & matching reducers, wherever necessary to complete the installation for feeding to the Antenna & Dummy Load as per AIR specifications. [Rates per meter/number shall also be quoted in addition to rates of quantity given in column (5)]			
3.1	1-5/8" RF coaxial copper Rigid (complete with outer, inner & insulators)			6 M
3.2	1-5/8" Un-flanged 90° Elbow with equal leg (complete with outer, inner & insulators)			4 Nos.
3.3	1-5/8" Clamp type Coupling (complete with outer, inner & insulators)			6 Nos.
3.4	1-5/8" to N Test Reducer			2 Nos.
3.5	1-5/8" Field Flange (Clamp type)			8 Nos.
3.6	Hanger for 1-5/8" RF coaxial Rigid Line			4 Nos.
4.	Supply of 10 kW Forced air cooled Dummy Load, 50 Ω as per AIR specifications.			1 Set complete
5.	Supply of RF Power Meter (dual type) with simultaneous FORWARD & REFLECTED power measurement suitable for mounting in 19" rack with separate Transducers/Sensing elements for measuring forward (≤ 10 kW) & reflected (≤ 1.0 kW), elements sockets, line section and 1-5/8" EIA flanges including all accessories, cables complete (2 Nos.) as per specifications for connecting with the rigid line.			1 Set Complete
6.	Supply of Four ports, 1-5/8" Motorized RF coaxial changeover switch with 1-5/8" matching EIA flanges for connecting rigid line including control panel as per AIR specifications.			1 Set Complete
7.	Supply of 2-Bay vertically Polarized Side Mount (Pole Type) VHF FM Antenna system complete as per AIR Specification including clamps etc.			1 Set Complete
8.	i) Supply of 1-5/8" RF Coaxial foam type Cable as per AIR Specification			60 M
	ii) 1-5/8" EIA flange Connector fitted at both end of the above cable			2 Nos.
	iii) Bullets (inners) for 1-5/8" Flange Connectors			2 Nos.
	iv) Hoisting stockings for each cable as per recommendation of manufacturer			1 Set
	v).Earthing kits for RF Coaxial foam type Cable			3 Nos.

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	vi) Wall gland/ feed through assembly with accessories for RF Coaxial foam type Cable			2 Nos.
	vii) Cable Clamps (adjustable height) with nut, bolt & washer			45 Nos.
9.	Supply of Stereo FM Digital Audio Broadcast processor complete with all accessories as per AIR specification.			2 Sets Complete
10.	Supply of Pre-wired Rack complete with all accessories as per AIR specification.			1 Set Complete
11.	Supply of 20 kVA UPS System with interface cables including Batteries and IT as per AIR Specifications.			1 Set Complete
12.	Supply of 30 kVA (at site condition) Silent type Diesel Generator Set with Automatic Mains Failure (AMF) Panel, Engine, Alternator, Control Panel including suitable interconnecting LT cables, Self-contained Acoustic Enclosure for ready to use basis with Service tank of minimum 65 ltrs. capacity with fuel pipe, dial type fuel gauge and complete accessories, battery system, standard tools as per AIR specifications.			1 Set Complete
13.	Supply of Ventilation Equipment Air Cooled Split AC (Inverter Type) as per specification [Qty. 1 Set Complete = 2 x 2.0 TR (Ton)]			1 Set Complete
14.	Supply of Automatic Audio Changeover Switch as per AIR Specifications			1 Set Complete
15.	Supply of Power Supply LT Distribution Boards with equipments/items as per AIR specification.			1 Set Complete
16.	Supply of Materials etc. and Earthing System of the complete setup as per AIR specification.			1 Lot
17.	Supply of 2 Nos. of Mobile containers having all the facilities and fully furnished as per AIR specification for working as a mobile broadcasting set up which can be transported anywhere in India as per requirement of AIR specification. [Qty. 1 Set Complete = 2 Nos. of Mobile Containers]			1 Set Complete
18.	Supply of 30 M Foldable Pneumatic/ Electro-Mechanical Tower along-with mobile trolley as per AIR Specification. # Quantity in Metric Ton (MT) offered to be mentioned by tenderer.			MT/1 Set
19.	Supply of any other items/accessories required for the completeness of the system. Items wise details (including part number, if any) are to be given by the tenderer). State NA, if not applicable.			1 Lot
	B. Works			
20.	Charges for Design, complete integration/installation, Testing & Commissioning of all the above Equipments/items (S. No. 1 to 16 except S. No. 7 & 8) in Mobile Containers as per AIR specification.			1 Lot
21.	Charges for Design, Installation, Testing & Commissioning of 30 M Foldable Pneumatic/ Electro-Mechanical Tower along-with mobile trolley with provision for keeping RF Cable drum & antenna system during transportation as per AIR Specifications.			1 Lot
22.	Charges for hoisting/fixing of VHF FM Antenna System & RF Coaxial Cable on the tower.			1 Lot
22.	Inspection charges as per AIR specification.			1 Lot

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

[illegible]

Annexure-I

INSPECTION OF TRANSMITTERS

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

All the testing/measurements including Operational & functional checking of the transmitter during PDI will be carried out at 105% of the rated output power of the offered transmitter.

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

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

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

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

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

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

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

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

ANNEXURE-II

TRANSMITTER TECHNICAL DATA TO BE SUBMITTED BY THE TENDERER

S. No.	Description	Details to be submitted by the tenderer		
1.0	Transmitter dimensions:	Width: .....(mm)	Height: .....(mm)	Depth: .....(mm)
2.0	Transmitter weight:	..... kg		
3.0	Transmitter Heat dissipation at 5 kW RF output:	..... kW BTU/ Hr		
4.0	Transmitter Air –conditioning requirement:	..... TR		
5.0	Number of racks:	..... Number		
6.0	Size of racks: Transmitter rack dimensions:	Width: .....(mm)	Height: .....(mm)	Depth: .....(mm)
7.0	Blower/Fan of cooling system (Total No. of Blowers/fans)	..... Number		
8.0	Power consumption at 5 kW RF output:	..... kW		
9.0	Typical Power supply line voltages (phase to phase voltages)			
9.1	Voltage between Red phase & Yellow phase:	..... Volt		
9.2	Voltage between Yellow phase & Blue phase:	..... Volt		
9.3	Voltage between Blue phase & Red phase:	..... Volt		
10.0	Typical Power supply phase voltages (phase to neutral voltages)			
10.1	Voltage between Red phase & Neutral:	..... Volt		
10.2	Voltage between Yellow phase & Neutral:	..... Volt		
10.3	Voltage between Blue phase & Neutral:	..... Volt		
11.0	Typical Power supply line current/phase current			
11.1	Line current/Phase current (Red phase):	..... Amp.		
11.2	Line current/Phase current (Yellow phase):	..... Amp.		
11.3	Line current/Phase current (Blue phase):	..... Amp.		
11.4	Neutral current:	..... Amp.		
12.0	Power factor:	.....	

ANNEXURE-III

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

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

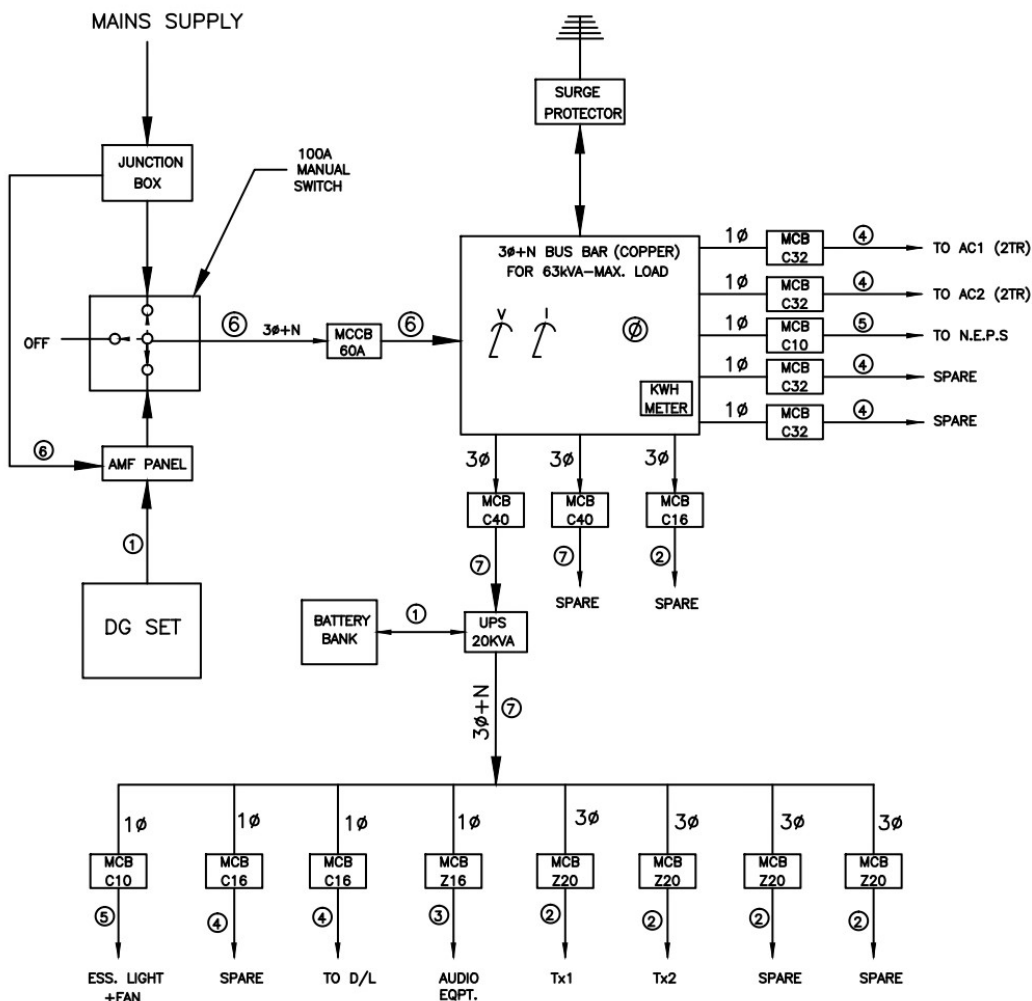
List of Places:

*For J&K region and Ladakh region.

*Actual location shall be intimated at the time of placement of order.

DRAFT

SUGGESTIVE SCHEMATIC OF INTEGRATED POWER SUPPLY DISTRIBUTION
OF CONTAINERISED 5kW MOBILE FM TRANSMITTER



- ① AS PER OEM RECOMMENDATION
- ② 4 CORE 6 sq. mm.
- ③ 4 CORE 2.5 sq. mm.
- ④ 2 CORE 4 sq. mm.
- ⑤ 2 CORE 2.5 sq. mm.
- ⑥ 4 CORE 50 sq. mm.
- ⑦ 4 CORE 25 sq. mm.

NOTE :-

BUS BAR PANEL AND WIRINGS :-

- (i) VOLTS & CURRENTS METERS, KWH METER, PHASE INDICATOR ETC. SHOULD BE IN PANEL.
- (ii) ALL CABLES / WIRES MUST BE OF COPPER WITH MINIMUM 2.5 TIMES OF SAFETY FACTOR
- (iii) DG SET, UPS & BATTERY BANK AS PER AIR SPECIFICATIONS

DRAWN By :- HARIOM

DRG. No. TM-16774

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